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SELECTIONS FROM THE RECORDS OF THE BOMBAY GOVERNMENT.,
No. VII.

REPORT

ON THE

MANAGEMENT OF CANALS AND FORESTS IN SCINDE,

BY

LIEUTENANT COLONEL WALTER SCOTT,

OF THE BOMBAY ENGINEERS.

108440

Printed for the information of the Revenue Officers under the Government of Bombay.

H. E. GOLDSMID,
Secretary to Government.

Revenue Secretary's Office,
8*th March* 1853.

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I.

ON THE PROCEEDINGS OF THE CANAL AND FOREST DEPARTMENT *AB INITIO*.

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1. Captain Baker, of the Bengal Engineers, was appointed to the survey and superintendence of water-courses, canals, and forests of Scinde, on the 1st of July 1843, with the following Assistants :—

Lieutenant T. C. Blagrave,
Lieutenant Maclagan, and
Lieutenant Whiting.

2. Up to the end of September 1843, Captain Baker was employed at Kurnaul, in collecting the instruments and apparatus required for carrying on the survey in Scinde, and in securing the services of various European and Native surveyors, formerly employed in the revenue survey in Upper India.

3. He arrived at Ferozepore on the 8th October, and was detained there for a few days by the sickness of his Assistants, but reached Sukkur on the 31st October 1843.

4. After a few preliminary details, laying down a meridian, &c., Captain Baker, as directed by His Excellency the Governor of Scinde, proceeded to survey and level two lines of road between Sukkur and Shikarpoor; while Mr. Hoppner and Corporal Craig were sent to survey the tract of country between the Scinde Canal and the Indus, which was completed about the 20th January 1844 by Mr. Hoppner. Corporal Craig was obliged to return to camp by sickness, and was subsequently returned to his corps.

5. After completing the survey of the Shikarpoor road, Captain Baker, together with Lieutenants Blagrave, Maclagan, and Whiting, proceeded in an easterly direction from Roree, with a view to examine the Eastern Narra, and ascertain the practicability of restoring to it its former stream, by the excavation of a new head. From these surveys it was Captain Baker's opinion that the most favourable situation for a new head would be at Roree : he therefore detached Lieutenant Maclagan, Lieutenant Vanrennan, and Serjeants Martin and Craig, to make a detailed survey of the rocks at Roree, while he himself, with Lieutenant Blagrave and Serjeant Thompson, was to survey the hills, and level for a new line of canal to its junction with the Narra, and thence down that channel to Omerkote. In the mean time Mr. Hoppner was directed, after completing his work on the Scinde Canal, to accompany Captain Malet, and survey the boundary being laid down by that officer between the bordering states and the British possessions. Captain Baker traced the western limit of the rocky hills about 50 miles south of Roree, where he found them to disappear under a range of sand-hills, which he could only trace 20 miles further, from want of forage and water. He therefore returned, and surveyed along the eastern limit of the rocks as far as Alore, and took an additional section across the drainage at the head of the Narra, and through an opening in the above hills, where the river once flowed, fortunately discovering a practicable passage for the new canal. He then levelled 79 miles down the Narra, to Fujjuck, beyond which he could not proceed for want of forage, but turned back in a northerly direction across the sand-hills to

connect his work with that of Lieutenant Blagrave's, who had been employed in levelling the plain along the rocky range; and afterwards, but unsuccessfully, in reconnoitering the sand-hills, in hope of discovering a level passage through them. Lieutenant Blagrave was then entrusted with completion of this cross-line up to the river bank, and then northwards to Roree.

6. Captain Baker returned direct to Roree, with a view to surveying some of the canals west of the Indus. On his return to Roree, he found Lieutenant Maclagan's party still there, owing to the frequent return of fever from which that officer suffered.

7. Captain Baker now proceeded to survey the west bank of the Indus below Sukkur, the Ghar or Larkhana Canal, and the Western Narra; Lieutenant Maclagan the Biggaree Canal, and Lieutenant Vanrennan the west bank of the river above Sukkur. Lieutenant Blagrave rejoined Captain Baker near Larkhana, and proceeded to level and survey some of the branches of the Ghar. Serjeant Martin was employed in surveying 32 miles of the west bank of the river to Teggur and Abad.

8. These surveys were completed, and the officers re-assembled at Sukkur on the 20th March, and Lieutenant Vanrennan was again detached to connect the Scinde and Ghar by a series of levels, and Lieutenant Maclagan was employed in surveying the rocks west of the river, and the cantonment of Sukkur. On being rejoined by Lieutenant Vanrennan, they proceeded with Serjeant Martin to Tatta, by water, en route to Kurrachee; Captain Baker left Sukkur with Lieutenant Blagrave for Hyderabad, inspecting the shikarghas on both banks of the Indus, but was detained till the 20th April at that station by a serious accident.

9. On arriving at Tatta, Lieutenants Maclagan and Vanrennan commenced a series of levels on the Kulleree Canal, to ascertain the practicability of establishing a water communication from the river to the Ghara Creek, but were obliged to desist from sickness and heat. The work was, however, completed by Captain Baker on his arrival at Tatta, and the result found favourable.

10. During this time, the boundary survey, east of the river, was completed by Mr. Hoppner, who then surveyed down the east bank, connecting his work with Captain Baker's and his own starting point at Roree. Serjeant Thompson surveyed the Shikarpoor and Nowshera boundaries.

11. In addition to the foregoing labours, astronomical observations were taken whenever practicable, with a view of fixing the latitudes and longitudes of various places. On the 31st May Captain Baker forwarded a report on the forests to the Secretary to the Scinde Government; and on the 24th June, Serjeant Thompson's rough protraction boundary surveys. About the beginning of July, Captain Baker was directed by His Excellency to proceed to the borders of Cutch, to report on the practicability of restoring to that province the supply of water which had been cut off, partly by artificial means, and partly by the Allah Bund, thrown up by the earthquake in 1819. On the 4th July, at Turea, he was joined by Mr. Hodges, Assistant Surveyor, and three Native surveyors, all of whom he took to assist in making the necessary surveys.

12. These surveys seem to have been completed by the 15th July 1844, on which date Captain Baker forwarded a report to Government on the state of the Goonee and Pooran rivers, and the various bunds thrown across them, which, on the whole, did not show the possibility of restoring the water to Cutch in a very favourable point of view.

13. Captain Baker's attention then appears to have been directed to a project for a navigable canal from Tatta to the Ghara Creek. On the 30th July he forwarded to the Scinde Government a copy of Mr. Hoppner's boundary survey. Captain Baker returned to Kurrachee on the 29th July.

14. On the 8th August Captain Baker proposed that Messrs. Hoppner and Hodges should be employed during the ensuing cold weather in surveying the various jagheers

in Scinde, to ascertain their respective areas, while himself and his assistants should carry on a chain of triangles to serve as a check on their work—an arrangement that was acceded to by His Excellency on the 12th August 1844.

15. Various reports were submitted by Captain Baker while at Kurrachee, a list of which is given below:—

August 23*rd* 1844.—A project for supplying the cantonment of Kurrachee with fresh water from the Mullaree river.

September 13*th*.—Memorandum on the irrigation of Scinde.

September 20*th*.—Report on the road between Sukkur and Shikarpoor.

October 8*th*.—Report on the upper portion of the Eastern Narra.

October 14*th*.—Report on canals west of Indus; Lieutenant Blagrave directed to report on the failure in the supply of water in the new Ali Buhr Canal, completed by Mr. J. Macleod on the 30th September 1844.

On the 14th October Captain Baker made over charge of the department to Captain Scott, of the Bombay Engineers, and embarked for Calcutta *viâ* Bombay on the 16th, with Lieutenant Vanrennan, on sick certificate.

[The foregoing is merely an abstract of Captain Baker's reports.]

17. During the cold weather of 1844-45 the following amount of field work was completed by the officers of the survey:—

From Captain Scott's Report.

Lieutenant Burton levelled	152	miles	of	canals.
Lieutenant Blagrave	„ 50	„		„
Serjeant Martin	„ 164	„		„

The above shows merely the actual length of canals levelled, but does not include cross-lines for check levels, which, particularly in Lieutenant Blagrave's case, were very extensive.

Mr. Hodges was employed in surveying the purgunnas of Kund oo, Khibranee, Chowah, Sekout, Pullaganee, Muttearee, Jekkee, Kotree, and Kuthan; Mr. Chill surveyed those of Nankee and Bhurda.

About forty-three of the forests in Upper Scinde were surveyed by Serjeant Thompson, so as to enable their areas to be calculated with sufficient accuracy.

Mr. Hoppner surveyed a portion of Upper Scinde lying east of the river, between Roree and Ghotekee.

Lieutenant Maclagan carried a line of route surveys from Cape Monze to beyond Larkhana.

18. In consequence of Colonel Waddington's departure, I was obliged to act as Superintending Engineer, and proceeded *viâ* Hyderabad and Shewan by land to Sukkur, where I found an order to proceed immediately with the execution of a bund from Sukkur to Abad; and, as there was no officer available, I was obliged to superintend this work, which is 50 miles long, myself, and was consequently detained in Sukkur till the beginning of September.

19. This was particularly unfortunate, as it put it out of my power to arrange the information collected during the working season, which could only be done by a person accustomed to the work.

20. I returned to Kurrachee about the end of September 1845, and made the best arrangements in my power to carry on the work.

21. During the hot weather of 1845 orders were received from the Court of Directors to proceed with a trigonometrical survey of Scinde, but the duties of the Canal Department being likely to require more time than could be spared from trigonometrical observations, it was finally decided by the Government of India that the great trigonometrical operations should be suspended for a time.

22. With a view, however, to make all the theodolite survey work which might hereafter be executed available for the purpose of filling in any triangulation, I commenced a secondary triangulation, which was ably executed by Lieutenants Edwards and Creagh, and Mr. Hoppner.

23. Some dispute existing respecting the boundary to the east, Mr. Hodges was sent to survey the disputed lines, with the intention, as it was understood, of rendering the duties of any committee or others who might have to survey the boundary more easy. The object seems to have been totally misunderstood by Captain Jackson, Resident at Balmeer, and Mr. Hodges was unable to do more than to complete a route survey from Hyderabad to near Balmeer.

Mr. Chill was employed in circuit surveying to the south of Hyderabad, to connect the surveys of the preceding season.

Lieutenant Blagrave and Serjeant Thompson were sent to connect Shewan with Captain Baker's work.

While Lieutenant Vanrennan was sent to survey the Kurrachee district, and to level the country with a view to ascertain the practicability of lowering the Kanjon lake, and also to have some data prepared by the time the canals were handed over.

Two of the Native surveyors were employed surveying the forest, and one was employed under Lieutenant Vanrennan surveying the road from Kotree to Kurrachee.

Lieutenant Mildmay surveyed on the east of the Indus, from Saikpoor to Shabunder, and east to Moghubin.

Lieutenant Campbell was employed on repairs to the bund in Upper Scinde.

Captain Scott in general superintendence; and the repairs to the bund at Sukkur being at the moment the most important work, remained there during March and part of April.

24. On returning to Kurrachee, I proceeded to reduce the surveys of the current and preceding year, in which, however, I did not wholly succeed.

In October 1846 I submitted reports on the proceedings from the time of my assuming charge.

25. It may here be remarked, that as all the officers attached to the survey belonged to corps either on the NW. Frontier, or to regiments marching from Scinde in that direction, the commencement of hostilities in the Punjab almost entirely disorganized the department; and, in spite of Sir Charles Napier's order on the subject, comparatively little was done. Surveying is a work which requires a man's whole attention; anything which disturbs him renders the work of little value.

26. The department being at length nearly complete, I was ordered to take charge of the entire detail of canals, and (after representing my own impressions on the subject, which were overruled) I did so on the 1st October 1846, and the following arrangements were made :—

Upper Scinde, Lieutenants Dancey and Vanrennan.

Central Scinde, Captain Wetheral, Lieutenants Pirie, Dawson, and Lambert.

[Lieutenant Vanrennan being detained in Kurrachee on Court Martial duty, Lieutenant Creagh was sent to perform his duties until he could proceed to his station.]

Mr. Hodges and Mr. Hoppner were directed to survey jagheers, and the Native surveyors were sent to carry on rough surveys south-east of Hyderabad.

Lieutenant Campbell was placed in charge of the Kurrachee district.

27. Not having seen the south-east portion of Scinde, I proceeded there in December, and did not reach Hyderabad till the beginning of January. I then found that, by some mistake, my most important letters had been detained there, and that the officers had returned the orders which had been given them for money, instead of cashing them and proceeding with the work.

28. The season was now far advanced, and it appeared almost impracticable for Captain Wetheral and Lieutenant Pirie to superintend, at that late season, the districts which had been assigned to them.

Lieutenants Dickson and Creagh therefore relieved them of some portion.

Throughout the whole season, the time of the officers was so entirely taken up by the duties of the canal superintendence, as they have to perform the same duties which were formerly (in the Hyderabad districts) portioned out to upwards of ninety Kardars, that they had no opportunity of executing any survey work, but the Sub-Assistants made some very fair rough surveys of the districts.

Serjeant Martin was employed to superintend the clearance of a district, but I do not think the experiment was successful.

29. Captain Wetheral was not confirmed in the appointment, and I accordingly lost his services almost at the commencement of the work, and was therefore absolutely forced to go on with it myself.

In consequence of the officers being entirely unused to any sort of work, it was requisite to reply immediately to the incessant references which were made, for which purpose I was constantly obliged to search the Collector's records; besides, as I was obliged to draw all the money required, and send it out by horsemen, I could not leave Hyderabad.

I was not able, therefore, to move about the districts until June, and the weather had become so hot that I could see comparatively little of the country.

30. I travelled, however, throughout considerable part of June, July, and August, and returned to Kurrachee early in September.

The usual difficulties arising from my absence were again felt, and it has been exceedingly difficult to reduce the plans to one map.

31. It will be remembered that a very great portion of the survey is compass work, and that such work not being in itself accurate, different persons' plans or surveys cannot be united without allowing for discrepancies; and to distribute this allowance fairly, so as to preserve the true proportions of each map, is a work requiring very great attention.

32. The maps, which will be shortly submitted, will show all that we have yet done, and the table and map of the jagheers show what progress has been made in them.

33. The tabular statement shows the strength of the department, and the employment of each individual.

34. Officers, even if fully instructed in surveying, cannot be made very useful when they join during the working season, after the general plan for the employment of the department has been laid down. Any increase or decrease in strength gives rise to change, and consequent confusion and inconvenience.

This would, perhaps, be less felt, if officers had been accustomed to surveying before; but when they join without knowing anything about the work, the attempt to teach them only takes another person from his employment, as, when a person is surveying, he should have nothing else to think of; and any attempt to teach people at that time only gives rise to confusion and mistakes.

Again, when they join soon after the close of the working season, they are not of much use, since there is generally time for the persons who have made the survey to reduce their own work; and here, again, the labour of teaching people takes others from their proper duties.

Officers who join in September and October have time to qualify themselves before the work is commenced.

35. I am speaking here of surveying and levelling only, that being the first thing which a canal officer ought to learn thoroughly.

To be qualified as a really useful Assistant, he must possess the following qualifications:—

1*st.*—He must level and survey accurately and quickly.

2*nd.*—He should understand the principles of running water sufficiently to know what to expect from any proposed plan.

3*rd.*—He must be able to design and estimate bridges of brick and masonry of moderate size.

4*th.*—He must be fully acquainted with the whole detail of the construction of such works, and the nature, quality, and mode of preparation of material, so that he may be able to instruct ordinary workmen. This is quite indispensable in this part of India, where the workmen are so ignorant, and some of the materials so very treacherous.

5*th.*—He must be a good and ready accountant.

6*th.*—He must possess temper, firmness, personal activity, and health, and he ought also to be a moderately good linguist: there can be no certainty of knowing what the people want, or giving them satisfaction, if their language is not understood.

Unless an officer has all these qualifications, he is of little use to me; and I would prefer employing a Native superintendent.

Without the whole of the above qualities he cannot exercise any efficient control, and he stands between me and the real person who executes the work.

The employment of incompetent Assistants, as it throws the execution of the work into the hands of irresponsible people, is positively mischievous.

36. Officers cannot be expected to acquire the qualities which I consider necessary without practice and instruction: those only who are likely to qualify themselves should be retained—others should be removed at once.

37. In general, public works cannot be carried on in a satisfactory manner, except by officers who have been regularly brought up to the business, and have had experience in the details of works.

38. In my opinion, there is no class of appointments where such experience is so requisite as in the Canal Department in Scinde. There are many questions requiring the attention of a Civil Engineer continually brought to notice, and it is curious to observe, that questions which have occupied the attention of the men best qualified to decide for the last 150 years have been frequently settled in Scinde on the simple dictum of a Kardar.

Such are questions relating to draining marsh lands, the methods of preventing overflow in embanked canals, the division of water, the construction of embankments, &c.

The fact is, that people require some slight knowledge of a subject before they are able to perceive the difficulties which attend it.

39. Great difficulty has hitherto been occasioned by the impossibility of my carrying on the duties of the department without myself superintending the works in detail.

It was always intended that my duties should assimilated to those of a Superintending Engineer, but owing to the sickness and removal of officers, and to the emergent nature of many of the works, I have hitherto had to superintend the details of many works myself.

As the department is now, I trust, at length settled, I believe I shall be able to direct my attention to my own proper duties.

40. Major Baker proposed that each Divisional Executive Officer should have Assistants, but none of the canal officers are competent, except Lieutenant Campbell, to form any judgment about works: there would, therefore, be no object in placing them in connection with each other.

41. The work has also been so new to them, that they could not hitherto have carried it out without incessant references to me: perhaps, therefore, the system which has been pursued, of making me draw the whole money, both for pay and expenditure, has not been a bad one; but for the ensuing season I certainly think that the officers ought to be placed in the position of Executive Engineers, leaving them to draw their own pay, and to answer for money for their own works, exactly as is done by the Executive Engineers under the Superintending Engineer, leaving, however, the Executive and Assistant Executive Officers quite distinct.

Unless this is done, I am obliged to remain at one place during the whole of the working season, to be able to send money out as it is required; and thus my control becomes merely nominal. As the bills on which their accounts are audited all come before me, and as the cash assignments, or, as they are called in Bombay, cash indents, for money for public works, are all countersigned by me, I think every efficient check is provided.

42. This alteration, or rather this adherence to Major Baker's plan, will enable me to move about the country, which I ought to do, both to look after the survey, and to see that the canals are properly cleared.

I must of course continue to draw for the survey department.

43. If it could be conveniently managed, my business would be considerably facilitated by paying the work-people entirely in money; and as the deductions would be made the same as if half had been paid in grain, Government would not lose: at present there is great delay in settling the accounts.

44. As we give the workmen an order for the grain, and they frequently do not draw the whole from the Ambardar, or grain-keeper, I am obliged to look over the Ambardar's accounts, and send fresh statements of the grain received.

45. Owing to this circumstance, I have not been able yet to settle the exact value of grain received from the Collector. The only difference would be that Government are now able to part with some portion of the grain without selling it: at the same time, I know that it must interfere to a certain extent with the sale of Government grain; for when a workman gets a larger quantity of grain than he requires for immediate consumption, he sells the remainder, usually at a loss to himself.

46. It was, very probably, with a view to prevent this sale, or to raise the price, that a sum of Rs. 2 (and sometimes more) per kurwar was invariably charged upon grain paid to the workmen above the sale price.

47. The prohibition to sending money by hoondies has also given rise to some delay and inconvenience, and the want of district treasurers has been severely felt.

48. Officers are not responsible for money, unless when it is under a proper guard, and therefore they ought not to keep it; but it takes so long to get money from Hyderabad to the distant districts, that they were obliged to do so this year, although they had only a guard of horsemen.

49. With respect to the reform of the canals, as I propose, to do that on an estimate sanctioned by Government there can be no sort of difficulty; but with regard to the annual clearance the case is different: here I cannot tell what is to be done before December, that is till I know precisely to what depth, with reference to the river, the canals are to be excavated; but I have no sort of guide as to the depth below the surface of the deposit until the middle of December, and then only with reference to the large canals; the work cannot be delayed to enable me to estimate, and to refer the subject even to the local (far less to the Bombay) Government; and to do so I would have to remain in one place, and to superintend the preparation of estimates, while I ought to be incessantly moving about to check the work itself.

In grasping the shadow of control, the substance would be effectually lost, and in fact this is the common error into which departments fall.

50. If it were left to my judgment, I would merely say to the officer, go down to a certain line, and, during the progress of the work, report what it will cost. The canal clearance is not a thing which can be rendered cheaper: the cheapest plan is unquestionably to cut as low as necessary, whatever the cost may be; a foot above that may save a thousand rupees in outlay, and cause the loss of the revenue.

It must be left to me that the canals are not cut deeper than is requisite: the canal clearance will in effect be two-thirds completed before it can be in my power to offer any estimate of the expense.

But if it be left to me, I must not be hampered with detail work, but left free to go wherever I consider my presence necessary.

51. I believe it is unnecessary to enter into any explanation of the difficulties I have had to contend against, arising from constant change in the department: the tabular statement shows this clearly. I have marked the officers who, owing to the periods at which they joined, and to sickness, &c. have been of no use during certain periods.

Such difficulties must always exist in any new department, and they are of course more severely felt in one where an officer is absolutely useless—indeed where he obstructs business—until he has had a certain degree of training.

(Signed) WALTER SCOTT, Major,
Superintendent of Canals.

17*th November* 1847.

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II.

ON THE NATURE AND EXTENT OF IRRIGATION AND CULTIVATION IN SCINDE.

1. In almost all other countries which depend upon canals, the course of the river from which the supply is drawn is either partially or wholly stopped by means of dams.

2. In Scinde, however, there is only one point between Sukkur and Roree where this would be at all practicable, on account of the soft nature of the soil; and if a dam was established at Roree, there is a positive certainty the river would abandon its present course, and assume a new one.

I am not at present aware of any means of preventing this, although it would appear, from common report, that something of the sort is being tried in the "Nile."

3. The small branches, also, are not dammed up: similar difficulties exist with them; and if they could be stopped, and the water consequently raised, they would fill up many years sooner than they otherwise would do, as, the current being less, the deposit would be greater.

4. The canals, therefore, at present contain water only when the level of their sole is lower than the surface of the river, and as the water is generally taken up at right angles to the stream, and not in the direction of its course, the canals receive little or no benefit from the motion of the water, and move under the same laws as water does when drawn by a channel from a reservoir, *i. e.* they depend solely for their velocity on their own depth and surface slope.

There are certain places, where, owing to the water lying in ponds or lakes, and to some other causes, such as proximity to the river, the people can cultivate throughout the year, but such cultivation is always by the wheel; and in general the districts removed from the immediate neighbourhood of the river are very scantily supplied with water, even for the ordinary purposes of life; and what water there is is usually (owing to the construction of the wells) peculiarly offensive.

This state of things lasts from October until June, or even till July.

6. The slope of the beds of the canals in Scinde is not above one-third or one-fourth of what is usually considered proper; hence the great tendency to fill up.

7. From the explanation, it is clear that, unless the river rises to a certain height, there can be no supply of water in the canals at all; and unless it rises before a certain period, or if it falls before the crops have ceased to require water, a failure of the crop is the certain consequence.

8. Although it is not in our power to raise the surface of the river, we are perfectly able to lower the bottom of the canals so as to receive the river water in the worst years, and then there would always be a certainty of supply, although the people would require to raise it a foot or two higher than during a good season.

9. As the banks of the Indus are higher than the country inland, the ground near the river is watered by wheels, but at the distance of 30 or 40 miles from the mouth, the water of the canal is usually above the level of the ground, and this cultivation is of

course by far the most valuable; it is capable of being much extended, and in some cases could be kept up throughout the year.

10. The cultivation in Scinde depends principally on the Indus and its branches; some small districts are, indeed, watered from wells, and some depend on the annual rains, but, in a general account of Scinde, such portions may safely be omitted.

11. A failure in the rains, however, gives rise to great inconvenience, as most of the water in the wells is derived from land springs, and in many places these, after a lengthened continuance of drought, become brackish, or even salt. The cattle also suffer severely, as the grass lands depend almost entirely upon rain. After a continuance of dry season the sand is very liable to rise, and do infinite mischief.

12. In a favourable season the barani, or rain-watered lands, are very productive.

13. Respecting the well cultivation, it need only be remarked that much of it is from temporary wells, lined with rough branches, or sometimes ingeniously supported by a sort of coiled plait of tamarisk, and such wells are principally used for gardens. The great objection to these wells is the extremely offensive taste and smell which they communicate to the water; and I cannot help thinking that the use of this water is one of the causes of the prevalence of fever in Scinde: from September until June, almost all drinking water is obtained from them, except in the immediate vicinity of the river or of dunds, the water from which is usually as offensive as that from wells.

14. The chief use of the wells in an agricultural point of view is to raise the young rice plants, and prepare them for transplantation as soon as the fields are prepared to receive them.

15. The Indus, from its entry into British Scinde, to a little below Tatta, throws off several branches, the whole of which are now dry during the autumn and spring, that is from October until the end of May. The most important branches on the right bank are the Scinde (commonly called the "Scinde Canal"), which runs past Shikarpoor, the "Western Narra," which, issuing from the river a little below Sukkur, falls into the "Muncher Lake," from whence it finds its way back to the river at Sehwan, through the Aral river.

16. This Aral river changes the direction of its current at different periods of the year, alternately flowing towards and from the lake. As lake Muncher is a very extensive sheet of water, and as the Narra, though a large stream, is not able to supply water so as to raise the level of the lake with rapidity, the river reaches a high level at Sehwan before the lake can fill. Now since water runs according to the surface slope, although the Aral has a trifling fall in its bed from the lake to the river, yet when the water in the river rises higher than the water in the lake, it must flow up the Aral. Again, the river falls with great rapidity, and leaves the surface of the lake Muncher higher than its own level; the lake then discharges itself through the Aral, so that the river is alternately a partial feeder to and a discharger from the lake.

17. Many propositions have been made to bund the lake, and restrain the spread of the water, and also to procure a more rapid desiccation of the lake.

18. But these projects, though they appear exceedingly simple to persons who have never studied the subject, are likely to cause very great expense; and this in a country where there is abundance of land which can be cheaply watered, and is now waste, seems to me worse than useless.

19. The river keeps close to the hills until it comes near Tatta, a little above which the "Kulleree Canal" (which eventually falls into the Ghara Creek at the village of that name) is given off; a little below Tatta another branch, called the "Bieghar," is also given off, which also falls into the Ghara Creek near Wagoda, about 12 miles from Kurrachee. These are the principal branches on the right bank of the river; the last, however, is a tidal creek from about the middle of its course: during the floods of the river it is navigable for steamers, but in the cold season the upper portion is dry.

20. On the left bank there is a branch above Halla, which is said to have been formerly the head of the "Phitta" river, but now it falls into a lake, from which it is drawn off in canals.

21. There are numerous remains of branches, but none now of any importance, until about 8 miles above Hyderabad, where the present "Fooleli" is thrown off; there is also another head to the same river a little higher up, but it seldom brings down any water, except in extreme floods.

22. The Fooleli is a large and rather rapid stream, and formerly passed between the hills about 20 miles below Hyderabad, and returned to the river not far from Jerruck, but it was artificially turned into the "Goonee," and its old course is now a canal.

The Goonee pursues its course towards Wunga Bazar, and is eventually drawn off almost entirely in irrigating channels.

23. About 20 miles below Hyderabad the "Pinyaree" is given off: it falls into a lake or marsh of considerable extent in the purgunna of Manyer, and, assuming the name of "Goorgee," runs on with a very sluggish but deep stream to Moghulbin, where it is divided from the sea-water (which at high tide comes up a creek) by a very large and fine bund, forming a fresh-water lake, the "Hadji." An artificial canal is derived from this lake, and conveys the water until it meets the Sultah Canal, and it eventually falls into the tidal waters through marsh lands. There is no other branch of importance on the left bank below the Pinyaree.

24. Below Tatta the river divides itself into several channels, but these are constantly changing, the current taking one or the other, without any very clear reason for the change being apparent.

25. The "Pooran," which was formerly given off high up the river (probably as high as Bhawulpoor), is now dry: it could not be restored without considerable expense; but if restored, or rather if a large canal was brought down the valley from Roree, there is a certainty of very large returns—Natives say that six lakhs per annum would be got. It is quite possible, for it passes through a country almost entirely unproductive from want of water, but possessing most excellent soil.

26. Many complaints have been made by the people of Cutch relative to the bunds thrown across the various branches. Captain Baker reported on the subject, and considers that Cutch might be improved by water from the Narra. There is every facility for making such a canal, as the mouth could be permanently constructed in the rocks at Roree.

27. There are many works which are now called canals, but which probably are merely improved branches; there are also many canals on the left bank of the river, of very large size; these will appear in the account of each purgunna—it would be tedious to repeat the names here.

28. It does not appear that the Ameers took any trouble respecting these branches: in fact, I scarcely think that much can be done to them by manual labour. They could be dredged, but I see no other way of keeping them open, although they vary, and are more or less favourable in different years; they are certainly, on the whole, all filling up—the lower end "Goourr" in particular is becoming more shallow and obstructed each year. It appears to me that the Indus in former times threw out many more branches than it does at present, and that there has not been any very material change in the course of the main stream. I judge this from the absence of the distinctive mark of a great alluvial river in the old beds which I have seen.

29. The accounts given by the old writers on Scinde are so very obscure that I do not see any ground for placing much faith in them, even if they spoke less obscurely than they do. Eben Batuta speaks of having come down from Mooltan to Sehwan in the fourteenth century, and also speaks of going to Lahara,—perhaps Lowara,—which

district is near the old bed of the Pooran, south of Wunga Bazar; but from his description of an old ruined city, with stones like men, &c., and like seeds, I am apt to think that he is confusing this with Tatta, where there are stones peculiarly like seeds, and where the limestone assumes extraordinary forms, which a little imagination might convert into men and animals.

He then returns to Roree, which he distinctly mentions as being divided by an arm of the Indus, just as Roree and Bukkur are at this moment.

30. It is an admitted fact, that wherever a river carrying mud runs through a country, it elevates its own bed and its banks, and in process of time comes to run on the summit or ridge of a double slope. This is clearly the case in the present main stream, and is not observable, so far as I can see, in the old beds which some persons have pointed to as the original course of the river.

31. The process of silting up the branches is at the present moment in action in the Western Narra, the Fooleli, and Pinyaree, &c.: these are all very small in comparison with the main stream, and all require assistance to enable them to keep open, even in the hot weather.

32. The channels forming the mouths of the river are much more nearly of an equal size, and are also strongly influenced by the tide: these seem to be the causes of the capricious change of channel which so frequently takes place in them.

33. I am not at all prepared to say that it is impossible for the main stream to leave the present bed, and to adopt that of the Fooleli or Pinyaree for instance, but it would be contrary to experience if it should do so.

The changes which have been taken place in great rivers,—in the "Po" for example,—occurred where two branches of a river were of nearly equal size; but none of the branches of the Indus bear any proportion to the river itself, except those forming its mouths, and these do change.

Again, we may be quite certain that the Fooleli and Western Narra, and the other branches, were once constant; some, indeed, have been so within the memory of man. The causes which led to their filling up yet remain, and therefore it seems safe to conclude that our difficulty would be in keeping them open, and not in preventing their taking too much water from the river. It is true that persons who ought to know declare that the Pinyaree was in former days merely a canal, which gradually enlarged itself: there is no documentary evidence on the subject, but if the case be really so, it is quite unaccountable why it is now filling up.

34. I am very anxious to make my opinions clearly understood on this point, because I am certain that little can be done in improving the irrigation of Scinde until these branches are made to flow constantly; at the same time, the soil is so loose and treacherous, that I could place no reliance in gates or locks, the expense of which would, indeed, preclude their use. Any dread, then, respecting the river changing its course, might very probably prevent what I consider a decided, and, in fact, a most essential improvement.

35. The country is watered in different ways:

1*st*.—The river overflows a considerable portion.

2*nd*.—There are a number of hollows, filled, partly from overflow of the river, and partly from waste water from the canals—these are usually called "Dunds," or "Kolabs": some retain water throughout the year; the greater number are mere marshes, and all could be easily filled by warping.

Although the first is independent of the canals, it is under control from embankments.

The second is closely connected with the canals, both from receiving the waste water, and because such dunds form the head or reservoir from which several canals are drawn. These dunds are sometimes artificially formed, becoming, in fact, properly speaking, tanks.

3*rd*.—Irrigation from canals, that is the supply of water direct from canals, without any assistance of machinery: this, as well as overflow from the river, is called "Saillabee," and in Upper Scinde "Mokh."

4*th*.—Irrigation by means of wheels, called "Cherki," &c. This commences from the very mouth of the canal; the irrigation takes place only towards the tail.

36. Canals are known by various names, such as "Wah," "Nalla," "Kurriah," "Gooj," "Kool," "Koor," and "Kussi."

The first usually means a large canal excavated by actual digging; the second a natural water course, which has been adopted by artificial means; the third generally means a small canal taken from a large one: but these significations are by no means strictly adhered to—I believe the four last names always mean small canals, derived from others.

The same general description applies to all: they are invariably cut with vertical sides, and the spoil banks, or excavated earth, is always heaped up close to the edge of the excavation. It is unnecessary to point out particularly the defects of such a system. I firmly believe that one-half of the present expense of annual clearance is caused by the falling in of the banks; that, in fact, we are annually raising an enormous mass of earth to the height of some 20 feet at an average, of which at least one-half falls back into the canal before the end of the season, and is thus moved year after year.

The second defect of the canals is, that they are very much too shallow, so that unless the river rises to a greater height than the average of late years, the canals can receive very little water. It is perfectly true that during the extreme floods there is usually plenty of water, but the river is very uncertain, and if it rises late in the season, as often happens, there is not time for the crop to come to maturity before it has again fallen. It is just the same if the river falls early. A steady supply is of more consequence than anything else, and this cannot be got if the canals are not deep enough to receive the water at a proper time in the very worst season.

Canals are frequently interrupted during the floods of the river, by one of two courses, which, although diametrically opposed to each other in their mode of action, are equally mischievous. Sometimes the strength of the stream sets directly into the mouth of a canal: as this portion of the river is invariably loaded with sand, and as the water, which rushes in with great velocity, must, owing to the decrease in depth and loss of slope, very soon lose its velocity, the sand becomes deposited to the distance of, perhaps, one or two miles from the mouth. Sometimes, again, the stream leaves the mouth of the canal altogether, depositing a sand bank where there was formerly deep water. And these changes usually occur suddenly; and although they certainly may be to a certain extent foretold, by watching the set of the river, they cannot be provided against.

37. It appears to me that if the canals were properly cut, so as to receive and retain water in bad seasons, that a guage on the river might serve as a fair guide as to the amount of crops; at present this is by no means the case, and it would appear from the revenue returns to which I have had access that the revenue is of the most fluctuating nature.

I feel confident that if the canals were properly cleared, lowered, and carried out on a connected system, so that the water should be fairly shared, the state of the river which now produces an absolute scarcity would merely diminish the exports. The revenue would increase in proportion to the rise of the river, but would never fall below a certain limit, unless the river should rise less than it has hitherto been known to do.

38. Again, another cause of difficulty is found in the shifting sands, which are blown in, and sometimes obliterate the canal. There is at the present moment a tract of moving sand at the Surafray Canal, fully 8 miles in length, and much more in the direction of its own course, which is unfortunately nearly at right angles to the course of the canal.

A change in the canal has been much urged upon me, but as the change would cost from thirty to forty thousand rupees, and when completed would place the canal under rather more difficult circumstances than at present, I have no intention of recommending it.

39. Canals are taken either from the main river or the branches: they are not carried without being made use of (as is the case with European canals) to the land best suited for irrigation, but almost from the moment they are taken off they are used to supply smaller canals, and the water is also drawn off by means of wheels.

40. Many large canals at present run side by side for miles: some ought to be suppressed, but it is not safe to do so until the one intended to be retained is properly enlarged.

41. It may fairly be said that the whole system of canals in Scinde is one of makeshifts and expedients to save some present expense, without the slightest consideration of the extreme inconvenience and positive loss incurred in consequence of the immediate saving.

42. The vertical sides of the canals is one example—the bridges which have been hitherto constructed is another. These are made by the neighbouring villagers, are usually so constructed as to form a very great impediment to the water, and, being floored with rough branches, covered with grass and mud, are absolutely dangerous: at the very best, scarcely one can be found which is not full of holes large enough to receive a camel's foot, and towards the end of the season the bridge has become perfectly rotten;—in fact, no person ever thinks of making use of a canal bridge if he can possibly cross in any other way.

43. These evils seem to have been long felt, and there are many abutments already built to receive a wooden flooring, but of late years this has not been considered necessary. The object appears under the late rule to have been to reduce the expenditure to the lowest sum possible, without reflecting that a trifling saving in the construction of the work entailed an annual heavy expense, and, in the case of bridges, almost entirely missed the intended benefit.

44. The present state of irrigation in Scinde is unsatisfactory; but this arises more from the imperfect state of the canals than from any deficiency in number. Many of the canals, indeed, could be easily dispensed with, if others were slightly enlarged; and, on the whole, little absolutely new work is required, except in the districts about Meerpoor and Meerwa, Ropa, and in the Oodeejanee and Summawuttee purgunnas. The remarks on each separate purgunna show their present state.

45. Persian wheels of various constructions are used. The "Hoorla," a wheel worked by one bullock, generally varies somewhat in its construction from the "Churki," a wheel worked by two bullocks, or a single camel. The construction of these wheels is very rude, but seems tolerably effective. It is rather in the execution than in the design that these machines require improvement. Considerable differences are found in different parts of the country, in the shape of the different parts. The machine consists of a pair of driving wheels, and a wheel carrying the water-pots: sometimes one of the driving wheels is dispensed with, and the pot wheel is worked directly by the cattle wheel;—this is the usual construction of the "Hoorla." The driving wheels cost on an average Rs. 14 a pair, and are said to last about fourteen or fifteen years; the wheel on which the water pots are hung is of a very rough construction, and can usually be repaired or constructed by the cultivators without much assistance from the carpenter; the earthen pots used to raise the water are sustained by rope, usually made of grass. On the whole, the annual expense of these wheels is not above a rupee, but the labour of the cultivators is not taken into account in this estimation.

The whole contrivance, though rude, is efficient, and with the very trifling improvement of a longer arm to the driving pole, which would enable the cattle to walk in a

large circle, and consequently to draw more fairly, I believe nothing better could be proposed when small quantities of water are wanted. However, in some cases eight or ten wheels are put close together—in such a case improvement could be advantageously introduced ; but merely as a single wheel to water a small quantity of ground, it is not likely that a change would diminish the expense. The wheel is seldom employed to lift water above eight feet; when that depth is exceeded, it is usual to construct two stages, and to use two sets of wheels.

A wheel, moved by a man walking upon it, called a " Puirattee," is occasionally, though somewhat rarely, used in agriculture, and a contrivance called a " Lota," which I have not seen, but I believe it to be merely a bucket drawn by a man. It may be, however, a bucket and a balance pole. Natives of India who cultivate about Kurrachee use the leather bag common in India : I am not certain that it is better than a common Persian wheel—it is certainly not so good as a well made one.

46. In some canals, more particularly in the southern part of the Hyderabad Collectorate, where the land is very low, the water is let in through brick sluices: these are not furnished with gates, but cross-beams are built into the side walls, and support branches of trees, and rubbish, which is thrown in when it becomes requisite to stop the water. Of course this rubbish accumulates in the canal, and does much mischief; but there will be no trouble and very little expense in furnishing these sluices with slip-boards—this can be done as the improvement of the canal progresses; the upper part of the sluices should be arched over, so as to allow communication along the bank,—they have been so formerly in many cases, but have now generally fallen into decay.

In all the canal accounts which I have yet recovered, I have only found one sluice mentioned as being built. The accounts, however, are exceedingly defective. Many of these brick sluices are apparently of long standing, but I have not been able to ascertain the dates of their erection, even from tradition. This is much to be regretted, for in some places the ground appears to have risen with reference to them, and in others there is no apparent change.

47. It is satisfactory to be able to state, from the state of these sluices, that the peculiar rot, which appears to affect the best brick-work in Scinde, does not touch such as is freely exposed to the action of fresh water.

Next in importance to the canals are the embankments.

48. The remains of old works of this sort show that great attention was paid to them in former times. Unless where the land is adapted to wheat cultivation, unrestricted inundation from the river appears to be dreaded: in fact, from Hyderabad to the sea, on both sides of the river, the embankments are an object of great solicitude to the cultivators. As at present constructed, they are most unsatisfactory: like everything else, the system has been one of saving immediate expenditure, and these embankments, which are constructed by alternate layers of earth and brushwood, and built as steep as possible, are in fact extremely insecure.

The face exposed to the river is annually faced with brushwood, but even this seems to afford little protection.

49. During high floods, they require to be sedulously watched, day and night, and are always under repair of some sort; they occasion much more trouble than the canals; and I feel certain that nothing could save them if a high wind and great fresh of the river occurred at the same time,—as it is they fail more or less every season. The water of the canals is passed through the embankments by means of brick sluices similar to those before described.

From the state of the sluices in general, I am not prepared to admit the truth of the complaints which are now so constantly made. It does not appear to me that the relative levels of land and water have altered since most of the sluices were first built; the truth

seems to be, that the people set up some remarkably good year as a standard of comparison.

50. In the total absence of old records, it is impossible to say, but there does not appear to me from local appearances to be any truth in the opinion that the water rises less than formerly: there is no doubt that the river is very irregular, both in the quantity and period of its rise, and this, by the way, joined to the extraordinary rises which I have known in the month of February, induces me to think that the rise of the river is more dependent on rain in Upper Scinde than upon the melting of the snows.

51. As the subjoined table shows the principal crops and their seasons, a very general description of the cultivation will suffice.

The land overflowed by the river, when of a proper description, is sown with wheat, barley, and gram; that which is sandy bears a small vetch (muttur) and mustard; land watered from wheels is usually used for badgery and jowaree, cotton, indigo, and tobacco; rice is grown on land irrigated from canals, and badgery and jowaree is also planted on such portions of this land as are not favourably situated for rice. The land under jowaree and badgery is not usually manured; when it is, it is cropped yearly, but usually the land is allowed to remain fallow for two or three years. Tobacco is invariably manured. The cotton of Scinde is usually a biennial crop, the second year being the most productive.

Owing to deficiency of water from September to June, sugar-cane is not much cultivated, but when there is water it is taken advantage of. The cane is smaller and harder than that of India, and the ordinary mill is similar to the common oil-mill.

Land watered by overflow is cropped annually.

52. I cannot form even a rough guess at the quantity of land under cultivation in Scinde. It cannot be got with any accuracy from the number of wheels, because the average of these varies very much according to the nature of the soil, and the height to which it is requisite to raise the water.

I have not attempted to distinguish the cultivated land in my surveys.

53. It will strike every person on first travelling over the country, that the cultivation is falling off; but the fact is, that the immense quantity of fallow land gives rise to this impression: for every acre that is at present under cultivation there are two apparently abandoned—this will always render it difficult to ascertain with accuracy the quantity of land under cultivation at any given period.

54. It may be generally stated, that north of Sehwan, the rubbee is the most important; south of that the khurreef crop bears a marked predominance.

55. I am not aware of a single instance of more than one crop being taken off the land within the year, nor have I ever heard of any rotation of crops being practised.

(Signed) WALTER SCOTT, Major,
Superintendent of Canals.

17*th November* 1847.

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31. Perquisites were taken besides the actual deductions 26

32. There is no reason to suppose that a properly laid out Canal ought to require much more Canal Clearance one year than another; the heads are liable to accidents, but not the trucks; the want of complete serials of papers renders those already got of comparatively little use; the Kalhara Records would be desirable, but are not forthcoming; the returns, however, show only the excavations done by the Meers; probably the Jagheerdars did an equal quantity .. .. ib.

33. The remians of old Canals and Sluices appear to show that former rulers were more liberal than the late ones 27

III.

SYSTEM OF CANAL CLEARANCE UNDER THE LATE GOVERNMENT OF SCINDE.

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1. This appears to be naturally divided into three distinct parts, each in itself forming a complete subject—

1*st.*—Respecting the party who paid for the work.

2*nd.*—Respecting the amount of the work.

3*rd.*—Respecting the mechanical detail, and method of settling with the workmen.

2. Respecting the party who paid for the work.

This is a subject on which I have been most anxious to obtain correct information, but it is closely connected with the revenue; and as I have no means of referring to the revenue records, I can merely state the case generally.

3. There are four different methods:

In all cases, I believe, Government paid for the clearance of large canals.

In many cases they paid for all the clearance.

In others, they paid in the first instance, and received back a portion from the cultivators: this is called "Sherakhultee."

In others, they made an allowance of a certain number of Casas in the Kharwar, and the people kept up the minor canals themselves, called "Mookhadinnee."

In others again, the people cleared their own canals, without receiving any allowance. In all cases the whole district was liable to be called out, when they usually received from Government a certain quantity of food: this was on emergent occasions.

I have endeavoured to show the particulars in the accounts of each purgunna.

4. I have not yet been able to detect anything like system: purgunnas apparently similarly situated are differently treated; nor does there appear, so far as I can see, to be any connection between the quantity of crops taken and the amount of assistance afforded. I have little doubt, however, that this apparent want of connection arises from my not having opportunity to study the accounts.

5. On the second head I have not been more successful than on the first.

The records which I have received are very incomplete, and the few which give any moderate number of consecutive years would lead to the conclusion that the system was to clear a canal, and then to leave it till it had become so much filled up as to be nearly useless.

There is no trace of regular annual clearance in each canal, and there is a distinct desire shown to excavate new heads instead of cleaning out old ones.

One very good reason exists for this at present in the main canals, viz. that the banks have attained such a height as to render any clearance exceedingly difficult.

They seem to have gone on therefore cutting new heads to the large canals, and they seem to have made few new ones—at least there are very few such in the records which I have.

6. It will be observed that the total amount of excavation in each purgunna is very considerable, although very irregular.

They had no means of determining with precision the quantity of excavation required, as they either did not know, or at least never used any instrument whatever.

It is difficult to perceive why some means were not adopted to keep the canals at a proper regular slope, and to retain a regular uniform width. At present the canals contract and expand without any reason whatever; and there is scarcely a canal in Scinde the banks of which are straight for a single mile.

The Native management of the canals was, in fact, entirely guess-work, and this continued to be the case even last season.

Such a system is necessarily a most expensive one, as there is a certain line to which a canal should be sunk to produce a full effect. Nothing below that is of any use, and anything left above it at once affects the revenue.

7. There was no attempt to combine the canals into one system; perhaps, indeed, it could not be done under the extraordinary mode of government of the Ameers; and the extensive jagheers must also have interfered with any such attempt.

Even, however, where it could have been easily done it was left unattempted.

8. I understand that the method was for the Kardars to send in estimates merely of the total sum they required, and the whole or a portion of the estimate was sanctioned, more according to the Ameers' ideas of the Kardars' character than from any real knowledge of what was necessary.

9. In Hyderabad and Kurrachee there are no less than fifty-six different sets of rules according to which the work is paid for.

I rather think that at some former period the rates were much more simple: the people were paid, probably, half in money and half in grain; and I have little doubt that the Rs. 2, which is usually added to the sale price of grain, was intended to prevent the labourer disposing of his grain, and thus lowering the market price.

It was, in fact, probably the difference between the wholesale and retail price.

In process of time it was probably discovered that the Kardars took a certain sum from the people, and this being discovered, Government took this dustooree to themselves. There does not appear to be anything very unfair in this: there is no good reason why the people should be paid more highly than is absolutely requisite.

The names of some of the deductions, as "one anna per rupee on account of prompt payment," convince me that this was the case.

I have given in detail one rule for deductions; for the other districts I have merely shown what the nominal amount and what the actual amount paid is.

10. Half payment in kind, though *not* quite general, was the usual system; and in the districts where this half payment in kind existed, the deduction is still kept up, even when the whole sum is paid in money, and is charged only in one-half when the whole is paid in kind: thus, supposing the sale price of grain to be Rs. 20 per kharwar, and I have to pay a Jemedar Rs. 200, say—

Money.....	Rs. 100
Grain.....	100

(now Rs. 100 of grain is 5 kharwars, and the deduction, being Rs. 2 per kharwar, amounts to Rs. 10;) the Jemedar, if I pay him in money, receives thus only Rs. 90 for the portion which ought to be paid in grain; but if, on the other hand, I pay him all in grain, I give him 5 kharwars for the first Rs. 100, and $4\frac{1}{2}$ kharwars for the second Rs. 100.

11. When the grain is dear, the people therefore are somewhat better paid than when it is cheap; if the sale price of grain was Rs. 50 per kharwar, I would deduct only Rs. 4, and so on.

12. Usually one rule applies to every part of a purgunna; sometimes, however, it varies in the different Dehs or Mukans, and occasionally indeed for each canal in the purgunna: whatever the rule may be, however, the people are thoroughly well acquainted with what they ought to receive, and always satisfied when it is shown to them that they are receiving the usual rate for that canal. The boundaries of some purgunnas have changed; the canal custom, however, remains the same, although the canal may be placed by the change in a district following a very different rule.

13. At first sight it does not appear clear that the Jemedars can understand their accounts, but I frequently found them club together to employ an intelligent Moonshee, with whom they directed me to settle their accounts.

14. The only point of dispute is the clearing away the small steps by which the earth is conveyed up the sides of the banks: this seems to have been always a matter of dispute, and it is necessary to take an average of years; but in other cases the rules have been very closely adhered to.

15. A custom exists in the lower part of the southern districts, which clearly shows that the people there come to work freely; they are paid both by the quantity and distance. Thus, conveying earth to 90 paces is called single work; when carried to 180 paces it is called double; and so on, being paid extra for every 90 paces to which it is conveyed.

16. I have endeavoured in the accounts of the purgunnas to make the subject as distinct as possible; nothing but practice, however, can make a person understand the minute details. Even in purgunnas where one rule of deduction is followed the rates of labour are different; thus in large canals it may be 18 guz the rupee, in small ones 25.

In most purgunnas there is a difference in price between what has to be carried out by the basket, and that thrown out by a hoe at once; this is called "Dhullee" and "Oochul" work; 6 guz per rupee is the ordinary difference in price.

17. In some few cases the work-people positively refuse to work at the ordinary rates—this occurs when the canal is very sandy, or when the banks are very high: in cases of sand it has been usual to measure the work late in the season, and to pay for what is then cleared;—this way is exceedingly unfair. In canals with high banks, also, the labour is four or five times what it was when the price was fixed.

18. I think the best way in these cases is to follow the Ameers' customs: they usually paid the usual price, and gave the people a present besides, or else they did the work by day-labour. The present could not be claimed as a right, which any advance of price invariably is.

19. The Jemedars whom I have mentioned are influential people, some of them bringing 100 men to work; those who come from Cutch are usually the most wealthy and influential; but the Scindees are said (by the Scindees themselves) to be the most trustworthy.

20. In the upper portion of the Hyderabad Collectorate, that is from the Doabh inclusive, to the north, there are comparatively few Jemedars, and they are all poor people (Scindees, bringing from 12 to 40 men to work); but towards the south they bring, as I mentioned above, sometimes 100 men, and are almost all Cutchees.

21. Most, if not all the labourers, are employed in reaping and thrashing the grain; it is therefore only after the storing of the autumnal crops that they can be collected for canal digging.

22. In November or December the Jemedars are collected, and each receives an advance, according to the number of people they can bring to work: the amount of advance varies from Rs. 2 to 4 per man.

23. The people continue to work until they consider that the quantity done is equal to the advance made: they then at once strike work, and can scarcely be persuaded

to go on for a single day; a second advance of about the same amount is now made, and this is usually in grain. The whole payment is usually made in three or four instalments, and all in advance.

24. As there is no time to measure the work during the progress, it requires considerable experience to know whether the people have really worked out their advance or not; it being of course extremely desirable to keep the work up to the advances as nearly as possible.

Such was and is the system for the large canals. The small ones are usually done by the cultivators, and not by the regular gangs of work-people; and as they have cattle, &c. advances to them may be made with more safety; but they are fully as unwilling as the others to work in advance of the payment.

25. The Kardar (or, where a large new work was executed, a separate agent) was employed to superintend the excavation, but a distinct set of persons called Ameens were sent out to measure the work.

26. These Ameens were paid according to a recognized scale, but the amount of pay is so small that it is most easy to imagine that the late Government were ignorant of its forming the smallest part of their emoluments.

One Moheerie was usually placed with each Ameen: sometimes the Ameen appointed his own—usually he was appointed direct, probably as a check upon the Ameen. These persons were furnished with a standard measure or guz, (which varies almost in all districts,) and went all over the works, the Moheerie measuring the lengths and breadths, and the Ameen measuring the depths.

27. To enable this measurement to be carried out with anything like accuracy, headings or bench marks, called "Thakees," were left in the canal; that is, a small part of the original bed was left in its former state. Pillars were also frequently left between the thakees.

28. Supposing the Ameen to be really honest, he might be imposed upon in three different ways: first, the thakees, instead of being placed at regular intervals, might be left where the canal required much excavation; secondly, the thakees might be built up; thirdly, the ground between two thakees might be left high.

29. Thus, even with a perfectly honest man, unless he was unusually observant, the measurement, being made by the eye, was not quite certain; but I believe there was more loss from collusion between the Jemedars, Ameens, and Kardars, than from any error of judgment. The measurement was entered in a small book (Khussa), and after that the calculations were made with the most scrupulous accuracy; these calculations being sent to the Dufter at Hyderabad, where they were carefully re-calculated, and the value of the work credited to the Kardar or Superintendent.

It does not appear that the Jemedar was usually called upon to pay up the balance; if any was due by him, he was generally allowed to work it out next year, or to pay it at the harvest.

30. The mechanical arrangements are exceedingly simple in the south-eastern part of the Hyderabad district: a slight attempt is made to use bullocks, attached to a sort of scrope, but in all other parts the earth is either thrown out by a hoe or carried out in baskets. I have seldom, if ever, seen women employed.

31. In addition to the recognised deductions made from the labourers, the Ameens had certain perquisites: for example, they often lived at the expense of the labourers; but these are matters which are not authorized, and as they certainly were not intended, it would be useless to inquire into them further than to guard against their repetition.

32. The amount of clearance given by the late rulers would probably have been quite sufficient, because, it must be remembered, that in addition to what they did themselves, at least an equal quantity must have been done by Jagheerdars; but, owing to want of

system, and utter ignorance of what was absolutely requisite, much of the labour must have been thrown away. There can be no reason why canals should require, if once put into proper order, a less expenditure one year than they do in another. The heads taken from the river are of course very liable to accidents; but, under a regular system, I feel certain that there would not be Rs. 5,000 difference in the whole canal trunks, supposing the cultivation to be stationary. It would be satisfactory to obtain a complete series of papers, but hitherto I have not succeeded in doing so. I fear that the Kalhara records are not recoverable.

33. From the remains of sluices and of very large canals, much more trouble and expense appears to have been incurred in former times. Among all the accounts which I have procured, I find only one for a brick sluice.

(Signed) WALTER SCOTT, Major,
Superintendent of Canals.

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IV.

SYSTEM PURSUED UNDER THE BRITISH GOVERNMENT.

1. The system adopted by the Collector of Hyderabad has been followed generally this season (1846-47).

The rule is that all canals of and above one guz area are to be cleared at Government expense.

The customs of the Meers as regards the payment for the work have been closely followed; the only change which I have made in the Collector's system has been to return to the original local measure of the guz.

Captain Rathbone fixed on a standard guz of 3 feet 9 inches, with which he measured all the canals; but, in order to obtain the prices to be paid, it was requisite to reduce this to the local measure; and this seems to have caused a good deal of vexation to the people. For instance, where the local guz was 4 feet in length, the labourers would not understand that 100 of the guz on which the price was paid was equivalent to 130 guz, nearly, in which the work was measured: this reduction added excessively to the trouble of the accounts; and as I could see no end gained by it, I promised to resume the old measure.

The system pursued by the Collectors until the year 1845-46 remained as in the time of the Ameers. In that season, however, it was changed, in so far that the kuniahs were altogether taken out of the hands of the people, and cleared at Government expense—that is, those of and above one guz in section. Such at least was the order in Hyderabad; but from misunderstanding on the part of Collectors' auditors, it appears that those which had one guz of absolute excavation only were admitted. This was at the time somewhat complained of, but when brought to the Collector's knowledge was, I believe, corrected. The system for which this general one was substituted can only be gathered from looking at the accounts of the purgunnas, and generally from the foregoing chapter.

2. I should most certainly have preferred receiving the canals on the old established system, which every person understood, but this was, perhaps, impossible when the revenue system was altered. I do not pretend to give an account of this new revenue system. All that is essential to my purpose is that 3 casas per kuriwar, that is one-twentieth, or 5 per cent. of the total crop, is supposed to be appropriated to the canal clearance. In addition to this there is a certain sum charged as "Huccaub," or water-rate, from the Jagheerdars.

3. I am led to believe that the aggregate sum will cover the amount of annual canal clearance usually, but I must leave it to the Collector's reports to point out what the amount is likely to be. It certainly will not cover the amount of reforming the canals, nor would it at all answer to make the amount of canal clearance tally exactly with the amount of revenue. This should be carried to account to meet the expense of canal clearance, which must always be carried down to a certain line, without any reference to cost, if the revenue is to be made certain.

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4. Nothing would be more injudicious than to contract the expenditure, and thus prevent the clearance, because a bad season had occurred: it would, in fact, be losing the greater portion of a year's revenue on account of a failure in the foregoing season.

5. As managed by the Collector of Hyderabad especially, there was, I believe, no difficulty about outstanding balances: the advances were made on the personal responsibility of the Kardar, and the work measured was placed to his credit. The Kardar was, therefore, personally responsible, and there could be no outstanding balance between Government and the canal diggers.

6. Now, however, the case is altered: the fact is, that the canal officers have not power or authority to enforce the payment of the outstanding balances; and, perhaps, such power could not usually be safely entrusted in the hands of the assistant canal officers, as too strict exaction of outstanding balances would very probably tend to prevent the work-people from coming next season; and, besides, the strict exaction of these outstanding debts by persons not responsible for the revenue would tend to impede the cultivation.

But it can scarcely be expected that an officer should subject himself to the inconvenience of having such claims by Government against him. Take the example of an officer being obliged to leave the country on sick certificate: he cannot expect that his successor should do more than recover what sums may be recoverable.

In case of death, or of the debtors running away, the officer has no remedy—he must himself bear the loss: this is a peculiarly hard case. It was so even with the Kardars, though, from their intimate knowledge of the people, they were more safely able to make advances than others.

Can it be supposed for a moment that they made these advances without establishing a reserve fund to secure themselves? I cannot believe that they did so. If responsibility is thrown on a man, he must, in justice to his family, provide some means of meeting it.

7. My proposition, therefore, is, that Government stand the loss of all advances made with proper prudence and precaution. I believe it will be said that no advances are necessary; but the fact is that from ancient habit and custom, the people expect to receive advances, and will not strike a stroke until they have them. Two courses remain open to Government: they may establish a system of forced labour, in itself a hateful thing, and requiring an establishment, and very strict rules to keep it in any sort of operation; or they may resort to day-labour. These two courses, and these only, are open to them.

The first, in addition to the great expense for superintendence, is a cause of discontent and real hardship to the people; the second would cost three times as much as at present, and, further, require a considerable establishment to carry it out.

8. Situated as I was myself last year, I could not pay any very minute attention to each work in the districts under my immediate control: the result is that I have standing against me Rs. 3,477-1-4 of outstanding balances, of which probably four-fifths at least will be paid up or worked out next year. Now the total quantity of excavation is 1,635,412 cubic yards, and the total expenditure Rs. 43,783-13-8, including outstanding balances: the cost of the work, supposing all the balances lost, is Rs. 2-10-9 per 100 cubic yards; while at the very lowest rate in Bengal (a country in which day-labour is 50 per cent. cheaper than in this) it is Rs. 3 per 1000 cubic feet, or Rs. 8-1-7 per 100 cubic yards;* so that under unfavourable circumstances Government have had work done for Rs. 43,783-13-8, including balances, which by the cheapest day-labour would have cost Rs. 1,32,457-5-4, in both cases exclusive of superintendence.† I therefore conceive that there is good ground to solicit Government to take the responsibility of the balances on themselves, since I have shown that they alone profit by it: the

* Captain Cautley's Report on Ganges Canal.

† The Bombay Railway excavation is estimated at Rs. 20-4-0 per 100 cubic yards. The Surat cut cost Rs. 21-2-0 per 100 cubic yards, removed to a distance of 60 yards.

officer making the advances must, however, show that they were usual and prudent, and it is the business of the Superintendent to see that they are so. I repeat that the people will not work at the rates they now do, without receiving advances.

9. In the cases of a very sickly season I have no doubt the loss from outstanding balances would be considerable.

10. It is perfectly impossible to get security from the common labourers, but when advances are made to regular cultivators, possessed of cattle, &c., of course the risk is very little; in fact, if we had the same opportunities of knowing the people that the Collectors have, and could trust to the Kardars, who must know them intimately, there would be no risk, except from deaths.

11. In October 1846-47 the department was nearly fully officered, although by gentlemen entirely unaccustomed to public works of any kind; and I took charge of the canal clearance.

I stated at the time my opinion that the ordinary work would be better performed by the Kardars, and my belief that if they were under proper superintendence, competent to show them what they should do, that there would be a considerable saving in the cost of Native superintendence; while the officers ,not being obliged to devote their time to vexatious though petty accounts, would be able to attend to the main objects.

12. The fact is, that an officer, whatever may be his amount of pay, or his talents, cannot do much more in the way of making out accounts, or superintending works costing each a mere trifle, than a good accountant at one-sixth the part of his salary; but if he is responsible for the details of expenditure, he cannot attend to the more important business of surveying and levelling the main canals. I certainly do not think that the Kardars alone would know what to do, nor do I see any reason to suppose that the Collectors could teach them.

13. Although I had obtained a good deal of information on the subject, yet it was of a very general nature; in fact, I believe that little was known of the details—these had all been conducted by the Kardars: it was, therefore, perhaps, fortunate that we were obliged to learn the method of working the system practically.

14. As soon as the charge of the canals was positively made over to us, I called on the Collectors to obtain estimates of what they wanted done, and also to direct the Kardars to afford us assistance, by pointing out where the various Jemedars were to be found. There was at first a good deal of reluctance, apparently, in the people to come forward, encouraged, I suspect, by the Kardars themselves; since, if common belief be well founded, they lost a lucrative branch of their business, by losing charge of the canal clearance. As I had every reason to think that the Kardars were altogether averse to the change of management, I requested the Collectors to obtain from them a report every ten days, as to the method in which the work was proceeding. I hoped in this way to prevent them bringing complaints against this department after the close of the work.

I was also anxious to know that everything was going on properly; for, with the exception of Lieutenant Campbell, of the Bengal Engineers, and myself, not a single officer had ever had anything to do with public works; and Lieutenant Dansey was the only officer really well acquainted with business of any kind; and in consequence of the removal of Captain Wetheral, and of being obliged to draw all the money myself, I was obliged to remain in my own district.

15. My precautions in obtaining these reports were, however, rendered perfectly futile by the steadiness with which all the Kardars complained; so that under no circumstances could I appeal to their reports in proof of the works having been properly carried on.

16. I did not obtain the old accounts till too late to make any use of them last season; and my time was so entirely taken up, and they required so much time and labour to

reduce them to anything like order, that they would have been useless. As it is, they are so incomplete, and the work has been done in such utter contempt of anything like system, that they will not even now be very useful.

17. In order to enable the officers to carry on the works at all, it was requisite that they should be supplied with some Native superintendents, and men were accordingly hired for the purpose, in the proportion of one to a moderate sized purgunna, at about Rs. 30 per mensem. The duty of these men was to send a weekly report of the quantity of work executed, and to report when the advances were nearly worked out; for, as I before mentioned, the people will not work without the payment being made in advance, and stop the moment they think that the work done is nearly equal to the advance.

18. The employment of these people, though, perhaps, as successful as ought to have been looked for, gave rise to much annoyance; and, in spite of all precautions, we were continually misled by their reports, while the work was very unnecessarily protracted, and work-people were allowed to absent themselves without any report being made. This was the principal cause of the amount of the outstanding balances. When these persons really exerted themselves, the balances were very small.

19. In addition to these persons, I found it absolutely necessary to give to Lieutenants Dawson and Lambert, whose work was the most backward, the assistance of a Native well acquainted with the work: this was very unsuccessful.

I have invariably found that it is exceedingly easy to get on with Native assistants, (indeed I prefer them to Europeans in general, where the works are small, as it keeps the cost of superintendence so much nearer a fair per-centage,) so long as they are directly responsible to a person fully equal to his work; but the instant they find an officer interposed between them and the head authority they become worse than useless.

20. In April, Ameens were appointed, and one copy of their measurements sent to me, and the other to the executive officer.

21. It was found that the rates of the canals varied so much, and that there were so many canals done this year, which could not be found in the accounts of the last two or three years, that the only thing that could be done was to make all their accounts out in my own office, as I had ready access to the old papers in the Collector's records, and transmit them to the officers; this proved exceedingly laborious, because it was quite indispensable that the accounts should be without error, as it was most desirable to make any settlement with the labourers final. I had, consequently, to examine every account myself.

22. I am happy to say that there were not above half a dozen cases where the people objected to rates which were assigned to their works: of course, when it was found that they were right, the account was altered; but usually we discovered that it was merely an attempt to impose upon us. The people were paid up in August (except in the Kurrachee Collectorate, which has been throughout later than the others, perhaps from the great number of small works).

23. The very minute care which was taken this year will make the payment for future clearances perfectly simple. I imagine that I have collected now the rates of almost all the canals in Scinde, and have had them put in a form in which they can be referred to. I have not, however, had them put into English. The expense of all English writing is so much greater than that of Native writing, that I wish to confine my work to that as much as possible.

24. On the whole, I would very much have preferred assuming charge of the canals on the system pursued by the Ameers in preference of adopting new systems, the effects of which could not be very clearly foreseen.

25. I have only a very general idea that the Jagheerdars pay a certain sum per wheel for the water they obtain from us, and I know from common report that it is not

uncommon to stop the supply of water to them when water is low in the canals, as it was last year; but I am not consulted in such points.

26. I am doubtful how far I should recommend a stoppage of the water, if my opinion was asked. Whatever lowers the surface of the canal towards its tail (the height of supply remaining the same) causes a greater superficial slope, and therefore a greater velocity. It seems to be thought by the Collectors and Kardars that water taken from a canal has the same effect in diminishing the quantity of water as if taken from a pond. On the contrary, I think that when there is a little water in the canal, where, as throughout all Scinde, the slope of the bed is very gentle, it is an object of very great importance to increase the surface slope as much as possible, so as to increase the current, and prevent deposit taking place; because, as the deposits increase, the possibility of a large body of water passing becomes diminished.

This is, however, true only to a certain point—there is a limit to the quantity of water which can enter the canal: all that I mean is, that in many cases the water drawn off would be supplied as rapidly as it is drawn off. I by no means intend to say that the supply of a canal is inexhaustible.

27. The mechanical method of clearing the canals is just as it was in the Ameers' time, and the system of payment could not be improved, though the work done might be altered with great benefit. With regard to the fund from which the clearance is paid, or to the employment of water after I have cleared the canals, I know literally nothing officially.

28. Much might be done to diminish the expense by the introduction of simple machinery. I dare say this may be doubted, but if it be, I need only refer to the street clearing machine now used in England. What is, however, particularly wanted, is to have means of expediting the clearance: the time at our disposal is not now sufficient to do everything well, and we are entirely dependent for about half of our labourers on people who come from Cutch;—it is only in a bad year in Cutch that any great improvement can be rapidly carried out in Scinde.

29. I have in vain attempted to trace some connection between the amount of produce taken, and the amount of assistance afforded: it is evident that there must be some connection—at least it is reasonable to believe that a system founded upon long practice must be adapted to the necessities of the case, although no system was intentionally introduced.

I have, therefore, endeavoured to reduce the main sources of taxation to a per-centage, and tabulated them for each purgunna: I believe they will be found pretty accurate. If I had had an opportunity of consulting the original papers in detail, I feel convinced I could have ascertained some general rules, which might possibly have been of use in regulating the assistance to be given in canal clearance; for as the different districts vary in their productiveness, I cannot think that one rule can be applicable to all: in this, I believe, I differ from the revenue officers.

(Signed) WALTER SCOTT, Major,
Superintendent of Canals.

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V.

ON INTERNAL COMMUNICATION IN SCINDE.

1. There are no roads whatever in Scinde, except those made by the British Government in cantonments.

2. A road from Sukkur to Shikarpoor was sanctioned by the Supreme Government, but it never was carried through. The object of this road was to enable troops to pass during the inundation, when the land between Sukkur and Shikarpoor is flooded: the estimate was based on the belief that the swamps and lakes about Luckee were formed by overflowings from the canals. From further information, however, it appeared that an error had been made in the level, and that the river overflowed its banks for a long distance. Until this is prevented, which is at present impracticable, on account of His Highness Ali Morad's objections, a made road cannot be constructed.

A Medical Committee has reported that the Luckee swamps do not affect the health of Sukkur, so that, on the whole, it does not appear likely that any further expense will be incurred.

3. There is convenient means of water carriage from Shikarpoor to Sukkur during the season when the road is inundated; a boat has only to be towed up the Scinde Canal to Abad; here it falls into the river, and is carried by the current to Sukkur, and a boat from Sukkur drops down the river to the Ali-Buker, pursues the course of that canal for a few miles, and has then only to be towed a short distance up the Scinde Canal to reach Shikarpoor.

4. Wells were also excavated in the direct road to Kotree from Kurrachee. If the wells are found to remain good, it will be very easy to make this road; it only requires, indeed, to be marked out, and to be made for two or three miles, where it crosses different ranges of hills.

5. In ancient times it appears that many of the brick sluices were arched over: these arches were very narrow, so that they would now be unfit for carts, even if they were in repair, but they are almost all in ruins. Brick abutments to receive a good flooring are also common, but seem to have been out of use for many years.

6. There is not a single cart in Lower Scinde, but in Larkhana and Shikarpoor there are a few, of very rude construction: the consequence is, that the people lose a market for all their coarser and more bulky produce, such as kurbee. I saw in last December large fields of kurbee about twenty miles east of Tatta, from which the people had merely cut the heads, and then turned the cattle in to feed upon the leaves; and this at a time when fodder of the coarsest kind was excessively dear at Kurrachee. The river bank is not twenty miles from the place I allude to, and there is water carriage at that season of the year to Gizree, within a few miles of cantonments. As the canals and smaller rivers would be perfectly impassable to horsemen, and as it would be even difficult for footmen to pass them during the inundation, it has been found necessary to organise some means of transit.

7. All the small rivers, such as the Fooleli and Pinyaree, and many of the small canals in the upper part of their course, have boats.

8. Whether these ferries are regularly let or not, I have been unable to learn ; they have not been placed under me : they are usually extremely bad boats.

9. The style of bridge across all the canals is the same: a number of piles are driven pretty close together into the bed; these are crossed by pieces laid transversely; the whole is then covered over with small branches, and on the top of this a quantity of earth is spread. These bridges are generally very far from safe, for they are almost invariably full of holes, and before the end of the season the whole structure has become so rotten that there is very great risk in attempting to cross them.

10. As bridges, therefore, they are not valuable ; but they are positively mischievous from the obstruction which they cause to the flow of the water in the canal, and from the mass of rubbish which has to be removed when the canal is cleared. But there is another point of view in which they do much harm : the uprights are so close together that no boat can pass through ; these uprights are never more than four or five feet asunder, and as they are formed of rough, crooked timber, and placed without any sort of regularity, the passage is effectually closed.

They are, however, constructed by the villagers without any expense except the wood to Government, and this is their only recommendation.

I think the small rivers, and, perhaps, the large canals, may still be advantageously crossed by ferries, if proper boats are constructed ; and I am inclined to advocate ferries for the large canals on the main roads. I have considered whether floating, suspension, or flying bridges, could be conveniently made use of; but on the whole I fear that flying bridges would not be quite certain, as the current of those streams is precarious, while suspension and floating bridges, if made continuous, would obstruct the course of boats, and any attempt at moving parts would be expensive in the first instance, and very liable to injury afterwards, considering the rough usage to which they would be subject.

12. With regard to the bridges across the minor canals, there can be no question but that this department should take charge of them : at the same time, although they may be to a certain extent useful on the present construction, when the people of the village are obliged to look after them, (and even now they are very imperfectly repaired,) yet, if they were handed over to me in their present state, as I have no means of enforcing their attention, they would become perfectly impassable.

Across all canals finally improved brick bridges should be built; and these would also be exceedingly useful, as they could be used as sluices also. Canals not properly and finally improved ought to be provided with proper wooden bridges; these should be made of good teak timber—nothing else will stand the exposure ; and a bridge, if it be made at all, ought to afford safe means of passage.

13. Lines of roads should, I think, be marked out. At present people experience great difficulty in finding the way, and with camels travelling should always be got through at night: good marks are therefore very essential. The most important roads are—

14. 1*st.*—Kurrachee to Tatta. At present the road, which is always difficult, from the heavy sand, between Kurrachee and Jemedar-ka-Tanda, is frequently almost impassable from the inundated country between Gharra and Tatta.

2*nd.*—Tatta to Hyderabad.

3*rd.*—Hyderabad to Roree. I presume His Highness Ali Morad would pay the expense of this road through his own territory: these roads should be made on estimate. In addition to this, there should be a road from every head town of a purgunna to the head town of the surrounding ones. All these roads could be easily made; in fact, they merely require to be marked out by a good ditch and mound, and the canal bridges.

The only regulation would be to prevent the cultivation being extended across them.

The expense would be very trifling for the roads themselves; the bridges would of course cost a good deal.

For the present Government need only make bridges on these roads, leaving the cross-roads as they are at present, until the canals are finally settled.

Across sandy tracts, where the ditches could not be used, brick pillars or wooden poles would suffice to show the roads.

I am not aware of any method of constructing a road across shifting sands, unless at an expense which would preclude the attempt.

15. There are some large fairs in Scinde; and, looking to the peculiar habits of trade of semi-barbarous nations, which usually resolve themselves into fairs, I think it might be worth attention whether some large canals or roads might not be improved leading to them.

The fair of Boorlee, for example, occurs in October or November: people from Jessulmere and all that district resort to it.

At present it is principally a public fair; but if goods could be cheaply taken there, which they might be by a canal, until August, it would only require a warehouse, which might be built for a thousand rupees, and a guard of police, to induce people to venture.

(Signed) WALTER SCOTT, Major,
Superintendent of Canals.

17*th November* 1847.

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VI.

VIEW OF WHAT SEEMS TO BE REQUIRED AT PRESENT.

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1. The very imperfect account which I have been able to give of the country makes it the more necessary to explain my own opinions distinctly: had it been in my power to submit a full and connected view of the present state of the case, I should have considered it presumption to bring my opinions to the notice of Government.

2. Scinde is a country capable of very great improvement, and possessing greater facilities for irrigation than any part of the Bombay presidency with which I am acquainted: at the same time, the population is not such as to render any immediate general improvement desirable. I mean to say, that if the whole of the arable land of Scinde could be watered next year, there would be no immediate commensurate increase in the revenue.

3. The most immediate object is, I conceive, to render the present canals as productive as possible, and to do this at the smallest possible expense.

I have already stated that the state of the canals—first, from the circumstances of two or more being used to afford a supply of water which could be amply furnished by one proper one; and, second, from the way in which they are cut, so that the same earth has to be raised year after year, is one great source of the annual expense; but at the same time it must not be supposed that a reform of the canals will do away with the necessity of annual clearance.

4. In a river carrying so large a quantity of mud as the Indus, and so apt to bring large quantities of sand into the canals, annual, if not more frequent clearance is quite indispensable.

5. The fall or slope of all the canals is far from sufficient to afford sufficient velocity to enable them to keep themselves cleared; but as the velocity of water, on which depends its power of carrying along extraneous matter, is a function of the depth and slope conjointly, it follows that very large and deep canals will deposit less matter than a number of small ones, the aggregate discharge of which is equal to that of the large canal, and the slope of the surface the same.

6. This is a clear and convincing reason why a large canal must be cheaper than a number of small ones, (the quantity of water being the same,) and to this may be added the great reduction in the expense of superintendence; it being of course much easier to superintend one large connected work than it is to superintend several small ones, at considerable distances from each other.

7. The number of large canals or main water-courses is generally too great, and that of the kurriahs or small water-courses is even more in excess.

8. The late regulation of clearing every kurriah of one guz section is likely, in my opinion, to have a very bad effect. The tendency of such a regulation is to induce the people to increase the size of the kurriahs beyond what is absolutely requisite—the entire expense is thus thrown upon Government; it also tends to increase the number of kurriahs, and to scatter the cultivation over the country, which evidently renders it more

easy for the people to conceal the amount of produce, and consequently throws more labour on the revenue officers.

But in every case labour is synonymous with expense, since, supposing the revenue establishment to be just capable of conducting their duties under unfavourable circumstances, they may be reduced in number if those circumstances are rendered more favourable without injuring their efficiency.

The wheel cultivation from the canals is usually one requiring fallows of two and three years' duration: it is a very common thing to find a kurriah cultivated near its extreme end only, the rest being fallow land; and in this way, by keeping some cultivation always upon a kurriah, it becomes absolutely requisite to keep the kurriah open; whereas, if it was ordered that such kurriahs as had a certain number of wheels at work should be paid for, however small the kurriah itself might be, we should induce the people to keep the cultivation together, and then it would be unnecessary to clean such kurriahs as were all in fallow land.

It has been suggested to me, that men might put up the wheels for the sake of getting the kurriahs paid for. I think this unlikely: there is considerable trouble in putting up a wheel, and it would seldom pay a man to erect a wheel for the purpose of imposing upon us; but if this was thought likely, it would be exceedingly easy to make the rule such that worked wheels only should count.

With respect to the Saibabee, or irrigated land, the question is not of so much consequence: the kurriahs are constantly in use, as the land has an annual crop, and can be kept nearer to their original size.

9. I fear the people are not usually able without assistance to clear such kurriahs as require extra workmen: my object is, not to reduce the amount of assistance given to the cultivator, but to prevent any expenditure on useless works. The system in India (Sannottee) was not good, because Government could not be certain that all the sum allowed was laid out. The system of partnership is perhaps a better one: the money is advanced to the cultivator, and he is enabled to clear his canals, without being forced to borrow from the Banian; but it throws labour on the revenue officer, and practically could only be carried out by the Collector's department. The references about so many small works between two separate departments would be interminable, and take up one or two officers' time entirely.

10. The method of improving the efficiency, and reducing the expense, of the main canals, seems to me to be as follows:—

First, to determine by careful comparison which large canal is most favourable; then to deepen this canal, so that it may receive one foot water at latest by the 1st June, the worst known year being taken as the standard of comparison; thirdly, to widen it so as to enable it to carry a quantity of water sufficient for the wants of the districts it has to supply; then to slope the banks, which in no case should be steeper than $1\frac{1}{2}$ horizontal to 1 vertical; and, finally, to remove the present spoil banks to a considerable distance, say at least thirty feet from the edge of the canal; the earth should be laid with a regular slope, and, where practicable, sown with some grass or creeping plant, which may tend to consolidate it.

The height of these mounds should in no case exceed six feet, and the slopes ought to be fully one in one and a half.

A space of thirty feet should be left outside the foot of the bank, and no sort of interference or obstruction ought to be permitted between these points; the berm or ledge between the hedge of the canal and the spoil bank, and also the exterior space, should be neatly levelled and sown with grass, and, for a reason which will be mentioned presently, with trees also. I would wish to have a hedge along the exterior boundary, but I do not know any plant which could be got to answer the purpose at present,—

perhaps the common milk-bush could be introduced: prickly pear, if it could be got, would be much better.

Without such regulations as these I cannot answer for the canals being kept clear: at present, in addition to the earth which falls in, bushes and trees, which are now allowed to overhang the banks, are continually getting into the canals, where they form a nucleus for large sand-banks.

From the want of side paths, and from the construction of the bridges, the canals are at present useless for navigation.

If it be objected that the banks as now proposed will take up much good ground, while I fully admit the fact, I may be allowed to ask what other course is open? Suppose the earth only removed a few feet from the edge of the canal, and heaped up as high as possible, say 20 feet, then a good deal of ground is saved certainly, but every basket full of earth which is brought from the bottom has every season to be raised this 20 feet; the employment of any machine, of a wheel-barrow even, becomes impossible; and from 50 to 75 per cent. is added to the annual expense of clearance by the necessity of raising the excavated earth to the top of the mound. The ground, however, taken up by the proposed section, will not be very great, and in most cases at least an equal quantity will be saved in the old canals thrown out of use.

In many places the earth of the present mounds can be used to elevate hollows and to level the ground, and thus the earth disposed of, at least for the present.

The object of leaving 30 feet on the outside of each bank is to afford space to dispose of the annual clearance.

11. Supposing the main canal, of which one or two would be ample in each district, to be thus laid out, I would next proceed to reform the kurriahs; these should be taken off at nearly regular intervals throughout the whole course of the canal.

I would introduce the water into them through a covered drain, furnished with slip-boards, extending through the whole canal ground, so that there should be no breaks or interruptions in the course of the banks; or, if that appears too expensive, perhaps a brick sluice arched over might answer. I would make the rest of the kurriah with a proper slope, and arrange it in a manner similar to the large canals; but as wheels would be required upon them, it would be necessary to allow of their erection. I would not permit the erection of wheels on the banks of the main canal; if water was indispensable, it could be got from covered drains; but as the kurriahs would only be a mile apart at most, it would be very easy to get the supply from them.

From the kurriahs of the 1st size others should be taken, and from this again kurriahs of a third size. By judicious arrangement, these kurriahs might be made to form the boundaries of farms or fields of a certain size; and then, should a more simple system of taxation ever be introduced, such as a rent per acre, the main question, that, viz. of area of cultivation, would be ready.

12. Such a system, too, would afford means of knowing with great accuracy the amount of land under cultivation at any period, with little chance of mistake; and this would be obtained without any vexatious interference with the people, or measurements of their lands, a thing which is always open to gross abuse, and which, when done with accuracy, is exceedingly expensive.

13. I do not propose to lay out the country in a series of fields of equal or proportional size: this would interfere with the present land marks, and would besides throw extra expense on Government in the first execution. All that I propose to do is to adopt, as far as possible, the present lines—to improve them, and to form them into one connected system.

14. In all the regulated canals and kurriahs I would build regular sections at short intervals, so as to regulate the future annual canal clearance without the expense and

delay of a fresh survey; in the canals likely to be done away with I would content myself with strong stakes driven into the ground, which would serve for the same purpose for several years.

15. As great loss sometimes happens from the river falling very rapidly before the crops have come to maturity, it is a great object to keep the water in the canals till after that period. It would be well worth while to build sluices for the express purpose. But if brick bridges are built on the canal, they can be very easily adapted to the purpose: the extra expense above the cost of the bridge would only be the price of a few slip-boards; a gate would not be required.

16. The chief difficulties to be anticipated with the canals, when they are reformed, will be—1*st*, the chance of the water from the river being cut off by a sand-bank, or by the current of the river loaded with sand settling into them; 2*nd*, from the moving sand tracts.

Some of the Italian authors advert to this class of difficulties, and recommend that the canal should be laid out as far as may be practicable in the direction of the prevailing wind. It happens, however, that we have it not in our power to attend to these directions, since the slope of the country points out with the utmost precision the path to be pursued, and it is unfortunately almost invariably at right angles to the prevailing winds.

17. With respect to the 1st class of difficulties, it can be, I think, met to a considerable extent by laying out three mouths at least to each canal. I think I have ascertained that the river bank shifts in some degree under a law; that is, supposing the waving black line to be the course this year, the red line will be that of the next season, the blue that of the third. It will require longer experience than we have yet had to ascertain this point with due accuracy. Hitherto I have not had leisure to make a minute measurement, but the points appear to me to retain the same relative position to each other.

If there be any truth in this idea, it will not be difficult to lay out three heads to each canal, so that neither of the first set of accidents can occur at the same moment.

When the river sets against any particular mouth, it may either be blocked up artificially, or, if the junction of the three heads is made at a point below that to which the sand is usually carried, that mouth will stop itself, without damaging the canal: the mischief does not consist so much in the expense of removing the deposit, as in the loss of revenue, if the water of the canal is interrupted during the season.

I have no doubt as to the success of this, for there are several canals with two or three mouths, some one of which is almost always open.

18. With respect to the second class, that of moving sands, I conceive the evil may also be to a certain extent palliated, if not cured.

It is clear to any person who has travelled much in Scinde that the forests are of the utmost value in checking sand-drifts. It is only on the plain, where there are no trees, that these became so serious an evil.

Great part of the district to the east of Hyderabad, towards the Suraffraz Canal, consists of a thin bed of clay, overlaying loose sand. When the upper clay is removed, which frequently happens from various causes, the sand below it is very rapidly blown out; the clay breaks away as the supporting body of sand is removed from below, and the mischief spreads. I believe that the enormous hollows, or rather holes, looking like old wells, which are so often met with in Scinde, are caused by the sand getting away, for the sort of sand of which I am now speaking is so fine as to have no consistency whatever when dry.

The same sort of sand is common throughout Scinde. In the mouth of the Scinde Canal, where it was saturated with water from the river, it assumed a most extraordinary

appearance, seeming like an elastic covering stretched over water; a man standing upon it did not sink, but when he threw his weight upon one foot the ground sunk under it, and rose under the other.

It is proved from experience that heavy rains consolidate the country, and probably spread the clayey covering over the loose material below.

One great object ought, therefore, to be, to give all this ground a thorough wetting from the canals at least once or twice a year, not with any view to cultivation, but simply to keep down the sand.

The second would be to plant belts of trees across the country, in lines perpendicular to the course of the wind, that is, along the courses of the canals: the quickest growing trees of the country are best adapted to the purpose. I believe that if these measures are steadily followed out on a connected plan, Scinde will gradually lose the sterile sandy appearance which much of it at present presents.

The banks of the canals would afford favourable situations for such belts, as they are nearly in the proper lines, and the trees could be grown with little trouble.

I have no doubt whatever that if Scinde was cleared of forests, as some think desirable, it would *all* be more sandy and sterile than much of it is at the present moment.

19. It will be remarked that I have not alluded to the Eastern Narra and Kulleree Canals as a means of improving the country. This is because every year that the canals remain in their present imperfect state, Government is paying certainly one lakh of rupees more than would be requisite if they were reformed.

Although it would be more gratifying to me to design and carry through a grand work (such as the Narra Canal) than it can be to engage in tedious, and comparatively, considered by themselves, trifling works, still the latter appears to be so much more to the advantage of Government that I feel myself obliged to pursue the course less pleasing to myself.

20. I would desire to supply the districts which can receive water from the river by short canals direct from that source, for when, as at present, the channels which ought to feed the inland districts are drawn in the upper part of their course, sufficient water does not remain to supply immense districts which have no other resource.

In certain cases, and to a certain extent, the supply will increase as the water is drawn off from a canal: but there is a limit to this; and in a very long canal it is quite possible to draw out the water faster than it possibly can come in. I would avoid, therefore, as far as possible, taking any supply from the Fooleli for instance, while it could be possibly obtained direct from the river, because the Fooleli does not carry sufficient water to supply the ground at its tail; and I would also regulate the quantity of water taken from the Fooleli by means of slip-boards, to restrain the water from entering the canals, so as to prevent its being allowed to run to waste in any part of its course.

Such are the general arrangements by which I propose to increase the efficiency of the canals, and to diminish the annual expense.

21. Many of the canals will shortly become quite useless, from the filling up of the branches which ought to supply them. I consider that this cannot be prevented without using dredging machines. These might be worked either by cattle or steam engines—the latter would be by far the easiest, and in the long run the cheapest. No time should be lost in obtaining them, as the machinery could only be made in England.

I cannot give a guess at the expense: there should be at least one for each of the branches from the river, (and two could be advantageously used,) say six altogether. Boats would be easily built for them here. The price could be ascertained by return of post if I was authorized to ask for it. The only description required is "a steam dredging machine, to work in 10 foot water on sand and mud, 6 horse-power, high pressure engines, to burn wood."

22. Without these it will be impracticable to keep the branches open; with them they might very probably be kept open all the year; and sugar-cane could then be introduced with advantage, and probably two crops per annum, instead of one, be obtained from the land along the banks.

23. The next subject which presents itself is one on which it is exceedingly difficult to enter without interfering with the Collectors' duties: at the same time, it is absolutely necessary to point out that the separation of the Collectors' and canal departments is one which throws much almost irresponsible power into the hands of the Kardars, and which places two departments in direct opposition to each other.

24. This would be of little consequence if our interests were the same; but that of the Collector is to increase the revenue—mine is to diminish the expense of clearance: unless the two are carried on fairly together, Government must lose. If I am too liberal in my allowances, I may be spending money for an object absolutely not worth the cost, while, if I am too saving, an object which might have been obtained at a small cost is lost.

25. In Bengal, as it appears from Major Cautley's reports, the entire management of the canals is in the hands of the Engineer, who receives from the people payment for the water which is delivered to them. This is a clear, definite system: people who buy water will never throw it away; but here it matters not to them or the revenue officers how much is wasted, so long as the individual gets his lands or the village lands watered;—each man wishes to take as much water as he can get.

The Kardar also, not perhaps unwilling to make his own districts better than the neighbouring ones, seems, I think, to throw in some cases unnecessary obstructions in the way of the others.

The same occurs with the Jagheerdars: they are sometimes too liberally, sometimes too hardly treated.

26. When a Kardar represents the necessity of more water, (and it is always to his advantage to have labourers in his districts,) if I say it is not the case, although I may be perfectly certain of being right, I have a pretty fair assurance that I shall be proved wrong: the answer of the Kardar to any inquiry about the state of the district is—"I applied to have the canals improved, and it was not done to the extent I proposed."

27. That this is not a mere idea of my own, the events of last year sufficiently prove. The tabular statements, showing the absolute expenditure for the three years preceding my taking charge, compared with the estimates of last year, are quite sufficient to show that the sum usually expended by the Kardars themselves was not considered sufficient when expended by another person.

It was absolutely requisite to know what the Kardars, who knew the country, wanted; and therefore I called for the estimates from the Collectors. If there was sufficient time to examine each case, and to compare the expenditure and the probable receipts, a division of the charge would only give rise to considerable correspondence; but there is no time to enter on such correspondence, more particularly as at that very time it is requisite for me and all the canal department to be moving about, and references could not possibly be made and replied to in time to carry out the work.

It is perfectly clear that estimates made by one set of persons, who have an interest in keeping them high, can never be carried out by others who have an interest in keeping the expenditure low, without incessant complaints.

The period allowed for the canal clearance is so short, and the work so heavy, that a minute inquiry into every disputed case cannot possibly be made, except in office, where all the requisite papers are forthcoming.

28. I really have seldom grounds at present on which to resist the applications of the Kardars backed by the Collectors.

29. Without intimate acquaintance with the revenue, I cannot possibly judge whether the allegations are correct or not.

30. Formerly, if a Kardar sent in a large estimate, and incurred a large expense, it was easy to compare the increase of revenue or cultivation with it; but not so now. He says—"True the Engineer has done a great deal, but not as I would have done it; he has left out so and so, on which the whole efficacy depended." This very answer was made this year, when on reference to the estimate it appeared that one kurriah without a name was the end for which a considerable canal was dug; in fact, I have no power over the water whatever. A scheme, however well designed, may turn out useless from the method it is made use of.

31. The interior distribution of the water must necessarily rest with the Native revenue officer. The Collector, even if he was competent to form an opinion on the subject, (and I believe the doctrines of running water are not familiar to every person,) cannot usually know much of the matter personally.

32. As at present situated, I am in fact subordinate to the Kardars: with them, and with them alone, the proper employment of the water rests; the Collector is not necessarily capable of forming any opinion on the effects of what they propose. To exercise proper control over the water, I should know not only the value of the purgunna, but the value of every field, or else I cannot tell where water is wanted.

I should be thoroughly acquainted with the holding of each Jagheerdar, and the amount which he pays to Government.

The entire distribution of the water should be in my hands, that in case of scarcity it may be applied to the best advantage.

In fact, the interior management of the canals is so intimately connected with the land revenue, that a separation of the two duties appears absolutely impossible—that is a separation to the advantage of Government.

33. The details which are required for the distribution of the water are so voluminous, and the necessary arrangements are matters of such immediate importance, that they cannot be communicated to another department: in addition to this, the extra expense incurred by a separate establishment is a matter of serious consideration.

34. Another circumstance has lately occurred which places me still more in the power of the Kardars: the Collectors have adopted the system of receiving petitions relative to my conduct of the works, and forwarding them to me for explanation.

35. In Bengal, in Italy—in every other country, I believe, the water is sold to the people; and of course the more water the canal conveys, the greater will be the returns. Not so in Scinde, however. The authority which clears and ought to plan the working of the canals has no sort of control over their employment. I do not think that such a system is likely to ensure good management, either on the part of the revenue or canal authorities.

36. To understand the duties of this department on the present system, it may be sufficient to refer to the abstract of expenditure for the past year: each officer ought to have attended particularly to each of the canals under his charge, since he had no person to whom he could safely entrust it.

37. The impossibility of his doing this may be understood by his merely recollecting that the works are scattered over an immense space of country; it was absolutely necessary, therefore, to have some persons to report on the progress of the works, and to communicate orders to the people.

38. One man in each purgunna was found not enough: he could not see all the work in any moderate space of time. Even, however, allowing that the extra establishment used last year had been efficient, they were a very heavy expense; and as they were only entertained for a temporary purpose, they tried and in many cases succeeded in protracting the work beyond a proper period, their object being to get as much from Government as possible.

39. After the water begins to run in the canals, they are liable in their present state to many accidents: trees get in, sand-banks form, bunds burst.

40. With the embankments the accidents may be most serious, involving entire loss of revenue, and even of life; guards or watchmen have to be kept up night and day; the whole population of the district is sometimes called on to exert themselves to prevent a threatened breach, or to close one already made.

41. I was so much struck with the impossibility of doing this, without keeping up an immense extra establishment, that I arranged with the Collector of Hyderabad, from whom I have invariably received every assistance, to continue the old system during the inundation, and to direct the Kardars and others to act as formerly, sending to him for transmission to me the bills for expenditure.

42. These bills are necessarily upon honor—it is impossible to check them in any way. In his districts the charges have been moderate; but they have not been uniformly so in other cases. I cannot of course say that the Kardars have charged more than they expended; but although the year was a peculiarly safe one as regard the bunds, some of the charges are rather higher than the average. It is quite evident, therefore, that this system is not a certain one, and that it will be eventually necessary to substitute persons of this department, over whom I can exert a direct control.

43. If the department in charge of the canals and of the revenue was united as formerly, the whole of the extra establishment for the superintendence could be dispensed with, and the work would go on as formerly. There might be some cheating I have no doubt, but as the European superintendence would be greater, and as the Kardars are not less trustworthy, I should presume, than men picked up for a temporary purpose, I should not anticipate a greater amount of peculation than now could be carried on.

44. Of course it would be requisite that the European superintendents should qualify themselves to check the measurements of the work, and merely as a check the labour is less than it appears: a few canals taken at random and re-measured would be quite sufficient as a check.

45. I anticipated difficulties from the very first, and I continue to think that comparatively little progress can be made in the reform, while the whole detail of the clearance rests upon us, without assistance from the revenue branch, particularly without assistance from the Native revenue officers. Their influence is necessarily very great, and it is impossible to expect that they will trouble themselves to exert this influence for any person but the officer under whose control they are; and however easy it may appear on paper to enforce this, it is well known that one servant cannot serve two masters; and it is pretty well ascertained that nine men in ten would not do so if it was in their power.

46. I fear, therefore, that the system of temporary assistants, with all its imperfections, must continue to be followed. I see no hope in the present system of revenue being able to adopt the Bengal system, and to sell the water. Then, indeed, people could not throw impediments in my way, and there would be every prospect of their using the water to the best advantage. I must say, however, that this system could not under any circumstances be introduced, except in a reformed canal, as the water must be given through masonry heads.

Perhaps it might have been owing to our being entirely new to the work, and to our having everything to learn; but I know that with every exertion we scarcely got through the current work, principally, indeed, from its being impossible to rely on any person in our employ, and, perhaps, from our not receiving more assistance from most of the Kardars than it was impossible for them to withhold. Perhaps the best method would be to leave the annual clearance in the hands of the Collectors, and to apply the Engineer department to the reform of the main canals; still in this there would be the annual loss arising from mistakes in the clearance.

47. Whether, however, the system be left as at a present, or be modified in any way, there is one thing perfectly indispensable—the establishment, namely, of a proper class of Native superintendents. At the present moment, if I require a slope cut, I must go and see it done. The Scinde labourer, and even artificer, is utterly ignorant of the use of every instrument for the purpose of levelling, even of a common Mason's level.

48. This necessarily takes away much from the efficiency of the department, as while the officer's time is taken up with the petty details, he must neglect something else; and Government are, in fact, paying Rs. 300 a month for work worth 8 or 10.

49. If I had at my disposal a body of instructed men, such as Sappers, I could send out one or two men to lay out all the detail, and to see that the work was properly done.

No attempt at reform can be made, or at least satisfactorily carried through, until such a body of men is at my disposal; neither can the annual clearance be performed with certainty and despatch.

If a company of Sappers cannot be spared, I would most strongly advocate a body of men being raised for the purpose, and that without delay.

I have sketched the strength which would be advisable in the Appendix, as these men would not get pensions; and as we want men in the prime of life, I would recommend their being enlisted, or, if that has too military a title, entertained under agreement to serve for seven years; they should be decently and uniformly dressed, and Natives of the country should be taken on account of the climate.

With the assistance of instructors from the corps of Sappers and Miners, which would, I suppose, be readily allowed, such a body might be made fully efficient in six months. The expense can be partly met by reducing some of the other part of the establishment, and by the saving in the extra establishment. They should carry a small brass number, like that of the Lascars, (to whom, indeed, they should be assimilated,) merely for convenience of identifying the men.

If bridges are to be built, some properly instructed people would be required for them also.

50. I do not consider that so extensive a project as the reformation of the canals in Scinde ought to be undertaken without the fullest inquiry. I should, I own, shrink from the responsibility of directing such an extensive undertaking in a country where health is so precarious, and when another person might have to carry out schemes commenced by me. I am perfectly certain that no real loss of time is occasioned by the delay requisite to acquire full information, and to institute particular inquiries: every plan ought to be so digested and explained in the first instance as to render future alterations unnecessary. The minute details of an extensive scheme are perhaps sometimes susceptible of alteration, but on the whole a plan should be so arranged, and fully considered at first, as to render changes unnecessary.

As regards the irrigation of Scinde there is one maxim to be adhered to, viz. to reduce the number of the large canals as much as possible, and to render them as perfect as the nature of the country will admit of.

51. The propriety of retaining certain of the present large canals is unquestionable, as, even where they are not laid out to the very best advantage, there is so much already done, and the expense of making them really good bears so small a proportion to that of excavating a new canal for the purpose which they now fulfil, that I conceive it would be improper to advise any alteration in their general line.

Such canals, therefore, as we know to be generally well laid out, are to be first undertaken.

52. When they come into action we shall be better able to judge what more is wanted, and we shall have time to ascertain the real nature of the doubtful ones.

53. Generally speaking, it will be very unsafe to cease clearing an old canal until the new one is ready, and is found to answer the purpose.

In short, the greater the caution in making improvements, the more likely are Government to profit by them.

54. I propose, therefore, this year (1847-48) to have estimates made in detail for such works as I have no doubt about; these may probably be sanctioned by Government in time for the next season (1848-49). It is quite true that this will postpone the improvements; at the same time, if I should be removed, the officer succeeding me would in all probability be otherwise at a loss to know what was intended; and not only would Government perhaps suffer, but I might possibly incur blame for what, had I been allowed to carry out my own design, might have appeared to Government under a different aspect.

55. With regard to the annual clearance of the canals, the question is different. The estimates cannot be framed by Europeans, on account of the climate, before the work is commenced, which it must be in December; estimates made by Natives are sure to mislead.

It is absolutely essential, therefore, that I should have a certain degree of latitude, as the work is paid by the piece; such a license leaves Government exposed to loss, either from want of water, or from unnecessary digging—the former is the one most to be dreaded; but it would be utterly impracticable to collect and arrange the mass of information requisite to enable Government or the Military Board to say whether I was right or wrong in the amount of my clearance. This could not be done with ten times the establishment I have at present, even allowing that they could commence the estimates in October, which we know they cannot do.

56. The system which I propose for next season appears to me to provide sufficient security, that is supposing that I am competent to direct the works.

When the canals were cleared this year, I had stakes driven in the most important ones, flush with the bottom of the canal; we can, therefore, recover the level of last year, although a deposit has since taken place.

I know, also, the rise of the Indus daily, and the dates on which it entered many of the canals: I am, therefore, able at once to say that a canal was deep enough, or not sufficiently deep last year; and I can tell how much to sink it below last year's level to allow the water to enter on any given day. And although, owing to many of the canals having been dammed to prevent the water entering on account of the measurement not having been completed, the entry of water into the canal did not correspond with the level; yet, knowing last year's level, and the level of the river, at the time the work may be undertaken, I can always fix the depth to be dug with considerable accuracy.

It was partly the want of this information which made the work so troublesome last year.

I am also able generally to fix the proper slopes of the beds of the canals, though widths must be determined by what has hitherto been given, it being only requisite to preserve it uniform, and not permit any increase in the breadth; a gradual decrease is of course allowable as the water is drawn off.

57. As the price per hundred guz for each canal is unalterable, it appears that on judicious instructions respecting the depth and slope depends entirely the expense of the clearance.

I cannot be in any way accountable for the amount of the expense; that depends entirely on the accumulation of sediment.

By taking the bottom line at too low a level, and by giving too great a slope, I might cause an extravagant expenditure; and by taking it too high, and making the slope too slight, I might cause the loss of revenue. But supposing that I fix on the correct

line of the bottom, I have no responsibility for the quantity of earth which it may be requisite to remove to reach that line; nor is it possible for me to exercise the least control over it. I am speaking of canals in their present state. I propose to diminish the deposit by the sloping of the sides of the canals.

58. With the double view of ascertaining correctly what depth has to be excavated to reach the proper line, and also with the intention of doing away with the measurements of the work by Ameens, I propose to put the whole strength of the establishment upon the canals about the 1st December: they shall put down fixed marks at regular intervals, to regulate the precise breadth and depth of the cutting; their measurements will also regulate the amount to be paid.

59. It is true, that as I have no persons at present competent to ascertain the correctness of the excavation between these marks, I may be to a certain extent imposed upon; but still one great object will be attained, and it will be more easy to detect imposition than when the canal is measured entirely by the Ameens and by the eye.

Should the people object to the amount of excavation allowed, it should be re-measured, and the expense of doing so (if the old measurement be correct) charged to them.

60. Great inconvenience has been found from the people being scattered over a great number of canals.

In place of this, the canals should be commenced in regular succession, and each entirely completed before another is commenced upon.

I propose, also, that each Jemedar should be furnished with a small account book, in which all the advances made to him, and the value of the work done, should be entered regularly: this will be particularly valuable if an officer falls sick during the working season. The greatest inconvenience was found from the want of something of this kind.

61. In future years the work will be easier, since the levels accurately determined this year will be marked by stakes driven in, which will be replaced by masonry or brick when the canals are reformed.

62. The very small canals, though paid for by Government, have usually been excavated by the cultivators themselves: it would not be practicable at present to lay down the levels of these—they may be safely left for the present to be carried on in the old system. Information respecting the small canals must be derived from the Kardars, and I must do what they ask, for I have no means of knowing whether they ask fairly or not.

63. With respect to the bunds, the expense likely to be incurred, and the extensive nature of the work, makes me desirous of reforming them on the same system as the canals—that is in a permanent way.

I would propose to estimate them, and to obtain sanction in the first place.

64. I have already stated that the bunds are of the most temporary and wretched description, by no means calculated to restrain such floods as they must sometimes be exposed to.

In addition to this there is another difficulty, which renders the stability of any ordinary embankment very problematical.

The river is continually shifting its course, sometimes cutting away half a mile of bank: against such change there is no practicable remedy.

There are no means available to direct the course of such a river as the Indus, or at least there are no means which could be carried out without involving an unlimited expense.

65. Still, as the cultivation of much of the country depends on the embankments, some means must be used to prevent the overflow.

66. The following occurs to me as a practicable plan, not involving any very heavy expense, and affording a fair chance of success.

I propose to erect two embankments, one as near the banks of the river as can be done with safety, unless where we desire to leave wheat land exposed to the inundations; another parellel to this, or nearly so, and at a distance of say a mile and a half.

These two bunds should be connected by means of cross-bunds at intervals, and means ought to be afforded to let the muddy water into the ground between the two bunds, and also to run off the water after it has deposited its sendiment, which it would do pretty rapidly.

By this means, and careful sowing of some of the creeping grasses in the fresh deposit, the whole bank for a distance of from one and a half to two miles in width might be gradually raised to the extreme flood-line.

It would never be safe to cultivate this, however, as the soil when loosened would be readily removed by the wind; the grass on the tract would, however, pay, or it might be planted with trees;—at worst Government would forbid the cultivation of a tract of land from which they now derive little or no revenue, and would be saved the expense of the present bunds. There is no necessity to raise the whole ground up to the river bank: land used for wheat could be left outside the bund.

67. It may be thought, that as the flooded land rises at present but very slowly, the present improvement would be very tedious; but the reason of the wheat land rising so slowly as it appears to do is that the water is seldom still upon it; and when this is the case there is no means of removing the cleared water, and letting on fresh water charged with sediment.

68. The water of the Indus during floods is so highly charged with extraneous matter that I have no doubt of the success of such an experiment, if the water was kept at rest till it had deposited, and then drawn off, and fresh water let on: at any rate, it would be worth trying, before attempting to make a permanent embankment—comparatively slight embankments, not much better than are now made, might answer the purpose.

(Signed) WALTER SCOTT, Major,
Superintendent of Canals.

17*th November* 1847.

(True copy)
(Signed) E. J. BROWN,
Secretary to the Government of Scinde.

MEMORANDUM ON THE WORKS AND SYSTEM OF IRRIGATION IN THE SHIKARPOOR COLLECTORATE.

I have hitherto made no remarks on the Shikarpoor Collectorate, as the system is entirely distinct from that followed in Hyderabad and Kurrachee. It is highly probable that this difference was originally occasioned by the greater part of the Shikarpoor district being dependant upon a Government far distant from the spot, while the Hyderabad and Kurrachee districts were so close to the seat of Government that the complaints of the people had a better opportunity of reaching the ear of the rulers.

I think it will be usually found that the more distant provinces, under a despotic Government, are more harshly treated than those close at hand.

It is not possible for me to view the subject in a fair light, as I only know the hardships felt by the people, without being aware of the advantages they may otherwise derive. I therefore profess to give an entirely one-sided view of the question of canal clearance in Upper Scinde.

1st, as to cost. I have already stated that the cost of canal clearance in Lower and Central Scinde is about one-tenth of similar work in India last year, if our measurements can be trusted, and I have no very correct method of checking them. The rate of canal clearance in Upper Scinde was only one-fourth of what it was in Middle and Lower Scinde, while the rate of labourers when they are hired is fully equal to that in India, varying from two to three annas per man per diem. On the other hand, I am well assured by Lieutenant Dansey, that the substitutes for statute labourers get sometimes as much as Rs. 8 per mensem from the cultivators.

In fact, the canal clearance is not paid by the Government directly in the quantity of grain issued for the people's food, but by certain allowances and deductions in the rent of the land. It would, therefore, require a more intimate knowledge of the country and value of the soil than is at present possessed to say what Government does pay.

The system, if understood by Government, may perhaps be a good one ; but it must be fully understood that the quantity of grain issued to the labourers is only for subsistence, and that it is not the real price paid : unless this is fully understood, comparisons may be drawn between two things of the same name, but which are perfectly distinct.

For example, when I charge say Rs. 40 per 1,000 cubic yards for work, (and if executed by hand labour I probably could not do it cheaper,) I am charging very much below rates in India, but in the next line of my estimate or bill there may be a charge for similar work at Rs. 10.

But it is perfectly true that Rs. 10 is not the whole cost; there are probably immunities allowed, sufficient to bring the whole amount paid and kept back from Government up to or beyond the sum which the work would have cost.

I must confess myself much opposed to any system where only part of the money is paid, and part can only be guessed at : if work must be done, it should, in my opinion, be paid for directly, and then every one knows what any work costs, and whether it is worth the expenditure ; but a system of burdening one department, by allowing immunities, while it makes the people look on the work as a grievance, is in all probability more expensive to Government than a fair open payment.

I have heard much of the statute labour of Upper Scinde. I can only say what I have seen. The people are brought to the work under guards; they are under-fed, and take every opportunity to desert, when they are traced out, and brought back like convicts, saving the chains; while in Lower and Middle Scinde the people come to work at their own accord, are glad to get it, and the attempts they make to impose upon us are just those which every person who is selling endeavours to put upon the buyers.

They are willing to sell their labour at a certain price; they are desirous to get as much more as they can. I believe the feeling is not confined to Scindees and Cutchees.

Respecting the interior arrangement of statute labour, I know nothing. I believe that every wheel furnishes a certain number of men, but I have neither been able to learn the rate or the number for each canal, or whether the system is applicable to the large feeders only.

The practice is to bring a certain number of men to each canal, and they clear it, receiving $1\frac{1}{4}$ pattoye of grain per diem; when the work is completed they return to their own villages.

His Highness Ali Moorad furnished certain quota of work-people for each canal, and last year he failed much, until H. E. Sir Charles Napier directed the Collector to entertain men on his account; if this system is continued, he will furnish men, otherwise he certainly will not do so. Much of his land lies at the head of the canals; any clearance we make benefits him, and his part of the canal must be cleaned to enable water to flow on to Government lands.

Lieutenant Dansey, who is in charge of the works in Upper Scinde, is a particularly active officer. While the works are under his care I feel no anxiety on the subject; but I know under less active officers it is very common for the supply of grain to run short, and the people are sometimes left for days literally without food. I know that this has occurred under the British Government, and that it constantly happens with His Highness' work-people, with whom we cannot interfere.

It would be very satisfactory if the Collector was directed to issue grain to His Highness' people, and to charge for it, or if Lieutenant Dansey was directed to ascertain that grain was really on the spot.

Apart from all considerations of humanity, I would desire this; and if the Commissioner should ever be mobbed by a party of these starving wretches, clamorous for food, which cannot be provided under a delay of some two or three days, he will more fully understand my feelings on the subject. I am speaking of what I have experienced myself.

There is a part of the statute labour system which must cause it to press unfairly on the people. The main clearance of the canals is generally at the mouth: people come to do the work from the whole length of the canal, therefore some have a distance of 80 to 100 miles to travel before they commence work.

What the system was in former times I do not know; the present one is to interpret the revenue regulations in the very strictest manner: the list of canals and the Kardars' estimates for last year show how small is the assistance offered by Government to what it is in Central and Lower Scinde.

I have myself no faith in the system. I know that the people will not prepare their small canals for a very bad season—they will always trust to the chance of the river rising; and, indeed, to the large cultivator, I imagine that a rather scanty year pays better than a full one—at least if one may judge from the sale prices of Government grain.

It is stated in the revenue regulations that in consideration of the reduction of rates the people shall clear their own canals. To render this operative it will be necessary to define what the clearance is, by fixing proper marks. The system of clearance of canals

in Upper Scinde is as vicious as that in Lower, though in a contrary way. By permitting or enjoining the people to clear their own canals, leaving it to their option to open as many as they choose, the waste of water is enormous: the quantity of water running into the Scinde Canal, if properly managed, is sufficient to water ten times the quantity of land now under cultivation, yet the people at the end are always distressed for want of water.

So long as this system is continued, the more the canal is cleared the more water will the people waste.

What is absolutely requisite is to restrict the irrigating canals, that is those taken from the main canal, to a certain number, and to force their clearance to a certain depth.

We are so much accustomed to large quantities of water in Scinde that we are apt to forget that, large as the supply is, it is not inexhaustible. The system of canal in Upper Scinde if applied to the New Ganges Canal, would drain it dry in 40 miles. If the system as at present in use is continued, the canals derived from the large ones should have proper brick mouths, and there should be some care taken that the canals are really cleared.

My opinion is, that while we interfere too much in Middle and Lower Scinde with the people, we take too little charge in Upper Scinde. I would propose to clear all large canals or main feeders, and all secondary, or those derived from them, so as to bring the water within about a mile of every man's field, and leave him to get the water as he can, limiting the quantity to be taken by masonry mouths to his small canals.

In all countries where water is sold, (as in Italy,) the people take the cost of the secondary canals. In Bengal they do the same, but here they are too poor, and the absolute necessity of canal water to raise the most ordinary grains seems a fair reason to treat them more liberally.

Should my view of the statute labour have any effect in remodelling the system, I must also add that any change should be gradual: if we throw up the statute labour at once, we could not replace it; it would require some years to introduce paid labour, as in Central Scinde.

The introduction of paid labour would probably have the effect of bringing in considerable numbers of people from Kelat, who, after a few years, would remain. Many of the Cutchees reside almost constantly in Scinde, where they can find employment, even when they do not cultivate, all the year round.

I transmit a table of the canals respecting which I have received information. I am not acquainted with those of the Mehur district.

The system of statute labour as applied to the great feeders, such, as the Biggaree, Scinde, Ghar, and Narra, is undoubtedly a cheap one, so far as the apparent cost is concerned. The evil of the system is that it does not press fairly on all the people, some having to come to the head of the canal from a much greater distance than others, and that it does not show the real cost of the work; but it is, I conceive, impossible to alter the system, as it is closely connected with the revenue of the country.

With respect to the canals derived from the main ones, such, for example, as the Noorwale, it seems that it would be unfair to put statute labourers on a work which does not affect their own lands; but free day-labour is so very expensive, and so little proportioned to the cost of canal clearance in other parts of Scinde, that Government could not reasonably sanction the expense.

As the people come from Cutch to labour in Scinde, it is certain that the money they receive for their labour must be sufficient. I would, therefore, though I confess reluctantly, recommend that the people should be forced to work, and paid at the average rates of the rest of the country.

The canal clearance is a work which must be done, and, however barbarous such a measure may be, it is the only means of guarding against a combination to raise the prices.

Under the rule of His Highness Meer Ali Moorad I imagine there is no hesitation at pressing labourers—in fact I have been led to believe that one reason of the deficiency of his quota last year was his having taken the people to dig his new canal. According to the plan I propose, the people will receive a remunerating price for their labour.

We have succeeded this year in getting about 100 Brahooees to work in the Kurrachee district; similar people will probably come to the Shikarpoor districts; and forcing the country people to work for a remunerating sum would not prevent this.

If this plan is approved, I would recommend the gradual extension of it to the large canals, doing away with the statute labour, and after a few years I think the people would come as willingly in Upper as in Lower Scinde to work; but they certainly would not do so for some time. I think if the system was commenced at once with the reclaimed tribes, they would come into it more readily than the old inhabitants: there is something so exceedingly plain and just in measuring the quantity of work done by a man, and paying him a fixed sum, that it could scarcely fail to be acceptable.

I would propose to advance a week's grain at first, and to deduct the value at a certain rate from the first payment, and to measure and pay up the people weekly; thus we would never have any heavy advance in the people's hands; but under all circumstances it would be requisite for the officer to see that the supply of grain did not run short. A fixed price for grain would be most convenient: but if the system was commenced in a cheap year, it might cause difficulties: at any rate, the grain ought to be given at an average rate during expensive years, and not at the sale price.

I dislike the system of grain payments; and when the canals are, as they will probably be in Upper Scinde, in barren places, I would prefer payments in money, and send Banians to supply the grain. My object in proposing the first payment in grain is to prevent the people running away with the advance, which they probably would do if they received money. I would not disturb the present system with the large canals immediately, but commence it at once with those proposed by Major Goldney. The fairest way to understand what should be the charge as respects the canals to Government, is to see what it is in other countries.

In Italy the canals included in the estimates are the real main canals—that is those which bring the water from the river, and carry it into the country. The water from these is taken off by branch canals and by measurement, the parties concerned buying each ounce of water as rigidly as they would buy a pint of wine: the sole care of the Canal Company is to supply sufficient water to fulfil their contracts, and to take care that more is not taken than is paid for.

In Bengal the system is somewhat the same: the trunk canal is formed, but Government seem to take no further expense.

Major Cautley took much trouble, and got the people to form companies, who constructed large branch canals (Rajbuhas); he seems to have superintended and managed these for the people's benefit, but Government had no share in it. Government built a head to each canal—that was to prevent their being robbed of water; and it seems to me that the people pay for the water according to the size of the head.

In the Hyderabad and lower part of the Kurrachee Collectorate we found systems; in Shikarpoor Collectorate, and above Sehwan; in that of Kurrachee there was no system; the work was paid for merely at the will of the person who sanctioned it. The various plans followed may be here usefully recapitulated:

1*st*.—Government defraying the whole expenses of clearance of the smaller canals, in partnership with the cultivators.

2nd.—Government granting a portion of the produce, usually I believe 5 per cent., for the clearance of the minor canals, and taking no further trouble about them.

3rd.—Government giving either grain or money at mere guess, without any check upon the people—that is, no real check by measurement.

4th.—Government doing everything.

All these plans are common, and perhaps all may be useful.

The words of the revenue regulations are—"All except the main feeders to be cleared by the people." In Kurrachee and Hyderabad main feeders have been interpreted to mean those of and above one guz area; in Sukkur it means the large canals only, of perhaps 15 to 20 guz area.

In Scinde, however, the food of the people is entirely dependant on the canals, and the canals are requisite, not merely to improve the country, but to render it capable of yielding any crop whatever.

The poorest cultivator must receive water, whether he can pay for it or not; this seems to render a more liberal system requisite. I conceive, therefore, that the Government should, in addition to the main trunk canal, undertake the charge of the rajbuhas (as they are called in Upper India). These are estimated on the Ganges Canal at two for every three miles of canal, and probably this estimate (made from considerable experience) is the lowest. They are not spaced at regular distances, but regulated according to the wants of the country.

I conceive that if these canals are properly taken care of, and masonry heads put to all the small branches taken from the rajbuhas, to prevent the unlimited draft of water, that all will be done which the case admits of.

Anything beyond this should be settled by the Collector's establishment, because the value of the work depends solely on the quantity of cultivation; but I would wish to have entire charge of the canals and rajbuhas, without any interference.

Proper establishments for the preservation of the canals should be put upon them as completed. In India one Chowkeedar every three miles is considered necessary for the large canals; and when these run between embankments it would not be sufficient.

The whole question turns on expense. I am at present preparing a survey of two canals which appear urgently required: the safest plan would be (if these are sanctioned) to do them after the best models; thus we shall clearly ascertain whether the advantages which will be obtained from them are sufficiently great to counterbalance the extra primary outlay, and cost of local establishment.

With respect to the bunds, if the method I have proposed be approved, I believe there will be little chance of extra contingent expenditure, and it could be checked through the crops, if canal superintendents were employed, who would also be able to superintend the canals when full, and the annual canal clearance, and execution of new works, so that there would be no period of the year during which they would not be employed.

While the canals and bunds are in the present very imperfect state, serious accidents may be anticipated: the Kardar or nearest person in authority ought to be allowed to set matters to rights, and even when the canals are put in the best order such accidents may probably occur. The canal officer ought, therefore, to be able to order the Kardar to assemble the people to repair such accidents, reporting to the Collector, but without waiting for authority from him. This levy of people, which is common in every country much dependant on canals, is well known in Scinde. It would be well, however, that it should be understood that the canal officers' orders on these occasions are to be obeyed without references.

As the canal officers are not Magistrates, some means must be devised for the summary punishment of persons meddling with the canals. Without this the officer's whole

time will be taken up in collecting evidences, and prosecuting people for injuring the canals, and he will have to leave his work, and proceed perhaps fifty or sixty miles, to appear before a Magistrate.

The canal officers in India have magisterial power to guard the canals, I presume because it was there found to be requisite.

(Signed) WALTER SCOTT, Major,
Superintendent of Canals, Survey and Forests, Scinde.

6th January 1848.

(True copy)
(Signed) E. J. BROWN,
Secretary to the Scinde Government.

MEMORANDUM ON THE FORESTS OF SCINDE, WITH ABSTRACT SHOWING THEIR EXTENT.

The accompanying tables show the value of the forests to Government, and secondly, the names of the forests, their total area, area now under cultivation, area waste, and area under wood, worth keeping up.

Under the late Government, the forests appear to have been merely hunting-grounds, and no attention was paid to the quality or description of timber. Usually they occupy good land, capable of cultivation: in fact, bad land, or land not capable of being watered, would not support the trees.

They were divided into "Belas" or forests, walled in, and "Moharis" or lands merely fenced in; and one forest usually contains both descriptions of ground.

The moharis are generally of stunted under-wood, or tamarisk; the belas are usually timber. In Central and Lower Scinde they were very strictly preserved, but in Upper Scinde, where, indeed, there is very little good timber, they were open to grazing in many cases.

The forests in Lower Scinde appear to have been planted; those in Upper Scinde are natural. Few of the forests in Upper Scinde are walled; in Lower Scinde they are surrounded by walls. Owing to the total want of attention to the timber, it is all very inferior to what it might be: most of the forests are impenetrable thickets, full of tangled under-wood, fallen trees, and creepers; and they are still further choked by the strong reedy grass of which chicks or curtains are commonly made in Scinde.

They were in fact exceedingly well adapted to the purpose for which they were used, namely, as a cover for wild animals; but they were very badly fitted for the growth of timber.

The products of the forests are—

Timber.	Bark.
Firewood.	Baubul Seeds.
Charcoal.	Grass.
Gum.	Reeds for Mats.
Lac.	

Timber.—The common woods are the baubul, bahur, and kundi; those more rarely met with are the tali (sessoo of Upper India) tree, tamarisk, jumbool, sirus.

The baubul grows to a larger size than is common in India, and I see no reason why it should be an inferior wood, as, although some of the forests are occasionally flooded, the soil is not marshy.

The timber (in consequence, I think, of having been used in an unseasoned state,) has been thought peculiarly subject to rot, and to attacks of insects. Its great weight and crooked grain unfits it for beams, and when exposed to alternate moisture and drought, as in bridges, it decays rapidly; on the other hand, the sound hard wood which is used for water wheels shows no symptons of decay for many years; and where a hard or crooked wood is required, as in wheels and sugar-mills, ploughs, &c., I believe baubul is the very best thing of the kind.

Captain Powell uses it for paddle-floats, and I believe for boat-knees, with great advantage.

The refuse wood is the best possible firewood for the steamers, and the charcoal is admirable for all purposes where great heat is required.

In fact, the timber, leaves, seeds, gum, bark, and lac of the baubul are all in constant use, and there are probably few trees of such extensive utility.

The bahur (which is according to Mr. Stocks a species of poplar) is next in quantity to the baubul: it is lighter, and more fibrous, but as it decays at the heart before it attains any very large size, it is not a very valuable wood for building purposes. The lacquered-ware made at Hyderabad is usually constructed of this wood, and it seems to adapt itself better to changes of atmosphere than any Indian wood, seldom spliting with ordinary care.

The kundi is somewhat like the baubul in appearance, but is of little value: it seems to be the natûral wood of Scinde, as it is found wild in most places. It attains to a considerable size in good ground. The wood is of a very inferior description.

The tali (or sessoo) can scarcely be called a forest tree, and I think the reason for keeping it out of the forests is clear enough: in the first place it is not of rapid growth, and secondly, it grows to a fine clear stem with few branches, and sheds its leaves entirely. The very circumstances, however, which prevented its being used in the forests, are those which hold out the best prospects of success to us. Dr. Royle says it is the best tree in Upper India: it grows very well about Sukkur, but probably would fail if planted much lower than Hyderabad.

The tree tamarisk is also a fine strong wood, and appears to stand moisture well. I have seen pieces which had been embedded in damp earth for several years without any bad effect. It is not at present plentiful.

The jumbool is also an excellent wood. As it is not very common, it is used principally for gun-stocks, and such like articles. It would make excellent building timber and planks.

It grows to a considerably larger size in Scinde than in the Bombay Presidency.

The sirus, though not very plentiful, grows well in Scinde, and the Natives have not the objections to its use in houses which they have in some parts of India.

The mountain or bitter nym grows well, though not very plentiful.

Except the kundi, all the trees above mentioned are extremely useful in some way, and all worthy of cultivation; but the baubul and tali are eminently so.

Gum is obtained from the baubul, but the price is so small that it is scarcely worth collecting. The extraction of the gum certainly does not improve the tree.

Lac is procurable, but in limited quantities. I am not certain whether it could be extended. It is, I think, the insect, and not the lac, which furnishes the dye. I have only seen it on the baubul: it may attach itself to other trees, but I have not met with it.

Bark may be obtained in large quantities. We have sent it to Bombay by desire of Mr. Treacher, when he took the tanneries, but have not heard how it answered. If I can succeed in making an extract, I believe it ought to sell well. I was discouraged at first from attempting it by the failure of the extract made in Australia, but as that arose from iron pans being used, and as I have procured earthen ones, I am sanguine as to success. Bark is a good deal used in distilling. Every new thing of this sort requires so much personal attention, and I have so little time at my disposal, that months sometimes elapse before I can attend to them: for instance, it was only in August last that I could teach my people how to burn charcoal; for, simple as the operation is, the Scindees are perfectly ignorant of it.

Baubul seeds are used for feeding cattle of all sorts, and also in the distilleries.

The grass in the forests (that I mean absolutely among the trees) is of little value; it is on the borders of the forests, and among the under-wood outside of the forests,

that the good grass is found. The people are allowed to graze in this on payment of certain fees: the object of taking the cattle into the forests is to allow them to browse on the trees themselves, and must of course be prevented in new plantations.

The reeds and thick grass are used for making screens and mats.

The soil of the forests having been for many years untouched, produces of course excellent crops, and the people were naturally extremely anxious to be allowed to cultivate it. During the first season, therefore, that we had possession of Scinde, and while the hunting-grounds of the Ameers were held up popularly as a curse to the country, the people found no difficulty in obtaining access to them. I believe that in Upper Scinde no attempt was made to preserve the trees, and most of the good timber has been destroyed.

In Centre and Lower Scinde the attempt was made, but the people (wisely, if they wished to derive all possible advantage,) contrived to locate themselves in the centre of the forests, and to scatter the cultivation through them in small patches, so that the woods could not, and cannot, be preserved without a very large establishment.

At present the complaints are incessant: the people claim a right to graze their cattle in their own fallow fields;—it is the claim to graze in the fallow lands which is the cause of dispute, and not the payment of the rate for grazing in the forests.

Captain Rathborne settled with me that as the people derived absolute and great advantages from being allowed to cultivate the forests at all, that they ought not to be allowed to graze free; he now changes his opinion, however, and says that the charge for grazing interferes with cultivation.

At present my time is much taken up with these forest disputes, and the people are so detached that I cannot be certain that I ever get the truth of any complaints: besides this, I am receiving money for what ought absolutely to be a matter of revenue, viz. the grass which grows on land that I have no means of planting. The two departments--the Collector's and my own—are thus mixed up in a way that it is impossible to draw the line. What I would wish to do would be to give up all land, not tree'd land, and to have that fenced in properly; to give up also all small patches of forest, as these require separate and extensive establishments; and thus to confine the attention of this department to the care and production of really good timber.

I am clearly of opinion that the woods in Scinde are extremely useful in preventing the drift of sand, and that they ought to be extended; but if, as I proposed in a former portion of this report, all the large canals are planted with trees, I think that 20,000 acres in Hyderabad, as much in Upper Scinde, and 10,000 in Kurrachee--a few forests, say four or five at most, in each Collectorate—to be kept by me, and the rest given up to the Collector,—this quantity of wood, if really taken good care of, would answer every useful purpose for which timber is likely to be wanted; and this wood only should, I think, be superintended by the department. It is, however, absolutely necessary to provide for fuelling the steamers, and woods must therefore be left near the fuelling stations: this prevents our given up many of the forests, which I would otherwise desire to do. It is, I think, absolutely certain that unless these woods are preserved, there will be, sooner or later, a very great want of fuel. It appears to me, however, that there ought to be a clear distinction drawn between the wood preserved for the steamers and the woods kept for timber. The fuel woods ought, perhaps, to be treated like copse-woods in England.

From these woods it would be absolutely essential to exclude cattle.

The thinnings of the other woods used for growth of timber would of course come into use, but would never supply the immense consumption which there now is.

Supposing that a certain extent of wood was given over to the flotilla at each fuel station, they could very easily take care of it, since they have always peons at their wood

stations, and the only care necessary is to exclude cattle, and plant seed, if wood is found not to grow readily from the stools.

If it should ever occur that a mercantile company undertook the navigation of the Indus, nothing would be more easy than to rent the grounds to them.

The above is the only way that I know of preserving the requisite wood at the least possible expense.

If good woods are grown with care, there will be a comparatively small quantity of wood for fuel; at least it would be a pity to apply wood to that purpose fit for any other, and the thinnings of the tali, &c. would come into use as rafters; it would only be the branches of the trees which would not be of marketable value.

If this proposition does not meet with approval, I beg to propose the following, though I think it not so good :—

1*st*.—To retain all the treed land; to give up to the Collectors all the ground not covered with trees outside the forests, and also all fields inside above ten acres, to be cultivated; also, in consideration of the fields under ten acres taken, to abandon to the Collector all detached clumps of trees of not more than ten acres.

2*nd*.—To make the people cultivating inside fence their own fields.

3*rd*, which is applicable to both cases—To prevent any grazing in the forests whatever.

4*th*.—To have periodical sales of forest produce.

This is not, in my opinion, so good a method as the first, as it keeps detached pieces of forest, which cannot be made to pay, on account of the expense of establishment.

Whichever plan is followed, the Collectors ought to prevent reckless destruction of the trees. It would be very easy for the Kardars to collect the grazing fees, though it is both troublesome and expensive to me, in consequence of the places being so scattered.

I have great reason to be dissatisfied with the present system : the people are continually complaining, and I know that they are in the habit of robbing the forests. This cannot be prevented while their fields are so intimately mixed up with the forests; and while they are allowed to graze in them it would be necessary to watch each herd of cattle. It seems quite evident, that when there are only two men for say 2,500 acres of forest, the people have the opportunity of removing baubul seeds, for instance, by bullock loads at a time. There are objections to my mentioning an instance at present, but I can show that we must have been robbed to the extent of Rs. 300 at least, solely, I think, owing to the people being allowed to go into the forests. His Excellency Sir Charles Napier intended that this department should supply fuel to the steamers on the river—the forest department was in consequence increased, with a corresponding reduction in the survey department. The experience of nine months convinced both Captain Powell and myself that this arrangement could not be carried out.

In the first place, the boat department is under the naval authorities: while the wood is cut and carried by the same authority there can be no dispute about the quantity; but I could not give wood over to any person without taking a receipt, which the boatmen were not competent to give; and I may thus be cheated to a very great extent.

Secondly, I could not with every attention anticipate the wants of the naval service. I am forced by my other duties to be in the districts, where letters may not reach me for days; while, if they issued orders direct to my people, I could never be certain where the people were, or how they were employed.

Thirdly, there was no means of settling the disputes which constantly arose between the Masters of the steamers and the people at the wood stations, without keeping a set of more expensive Moonshees. This was found most vexatious in practice. And finally, the wood which is taken by Captain Powell is got at prime cost, while when provided by me Government were put to the expense of an establishment. Captain Powell contracts with people to furnish a certain quantity of wood; I do the same, and say at

the same price.* If I am to receive the wood from the people, and issue it to Captain Powell, there must be an intermediate establishment, while if he takes the wood direct, and I pay for it, there would be an incessant dispute as to quantity, and no possible end gained by my interference.

The arrangement made by me with Captain Powell is, therefore, that he should continue to supply wood for himself, and that he shall buy from me such refuse wood as comes out of the clearings of the forests annually. In this arrangement there can be no mistake, and Government does not pay an anna for establishment beyond what is strictly necessary.

The wood-cutters do not injure the forests: they seldom cut baubul wood, as it is very hard, and their clearance does good rather than injury in the present tangled state; they could not be allowed in improved wood.

It can always be arranged where they are to cut. Under this arrangement the expense of the forests' European establishment can be reduced by at least Rs. 200 per mensem, and the survey establishment restored.

The returns from the forests do not show by any means their value to Government.

In the first place, the Camel Baggage Corps are allowed to occupy the forests free: this causes a total loss of grazing fees, and the camels and men do much mischief.

Secondly, wood for agricultural, and in fact for almost all purposes, such as rebuilding villages destroyed by a fire, &c. is supplied free to the people; fuel is also supplied to the navy merely for the cost of cutting.

If either arrangement before proposed be sanctioned, I think the people should be obliged to pay for everything which they get from the forests: they will have plenty of wood given up for present purposes; and it can scarcely be expected, even by them, that Government should go to the trouble of planting and looking after trees for their sole benefit;—if they want wood free of cost, they can plant trees near their villages; there is wood enough to last until these grow.

I have no doubt that under either of the above arrangements Government would derive a larger sum than they now do—at least a great portion of the expense would be saved; for the machinery for realising the general revenue of the country could have no difficulty in realising the grazing fees, while it is requisite for me to have my establishment now solely for that purpose.

I cannot help thinking, too, that when so much land is given up which the people are anxious to cultivate, it would be practicable to introduce a more civilized system of revenue than payment in kind.

The improvements in the forests consist in clearing away the under-wood, and thinning the trees.

Considerable quantities of seeds have been received from Dr. Gibson, but, probably owing to their having been detained in Bombay, many have failed.

I have received through the kindness of Mr. Roberts, Government Timber Agent at Surat, several packages of teak and sewan seeds. I fear that all the teak seed has failed, but large quantities of the sewan have come up, and some of the seed sent by Dr. Gibson, although, owing to the stupidity of the gardener, the names were misplaced, so that as yet we are not quite certain which have failed.

I have also large quantities of tali (in a good state of forwardness), and peepul, the latter, though not useful as timber, forming excellent forage for camels.

The first trees planted out will be natives of the country, such as tali, sirus, &c., restricting the attempt to introduce new wood until we know what will answer. About some

* The wood is not charged for; the cost is merely the price of cutting.

woods there can be no doubt,—the bhendy for instance,—but I doubt the success of teak and some others; mahogany would probably answer; but these are matters to be determined from experience.

The rate of boat-hire is so great that we are unable to supply Kurrachee or any distant place with fuel at a remunerating price.

I am not at all anxious, however, to realize money by the sale of firewood. Everything of the kind requires an establishment. If proper boats were introduced, people would probably buy wood in the forests, and remove it themselves. This I think would be much better done by the Kardars, who are on the spot, leaving this department at leisure to look after the improvement and growth of timber.

(Signed) WALTER SCOTT, Major,
Superintendent of Canals, Survey and Forests, Scinde.

Kurrachee, 6th January 1848.

Abstract of Forests, showing their Areas.

Names of Forests.	Total Areas.	Areas in cultivation.	Waste Land.	Wood Areas.	Remarks.
Phutta Kheeral Purgunna	284	41	..	243	
Mukbool Moradpoor P.	796	..	752	44	
Hazareebelah Kheral P.	2,871	2,640	231	..	
Kheersur Kolit Almah P.	2,094	627	..	1,467	
Pennah Wallisha Daeheree P. ..	1,215	600	100	515	
Rambooree	527	..	..	527	
Kudhee, Kudhee P.	1,762	362	..	1,400	
Goondee Doabh P.	167	..	..	167	
Meer Mahomed Doabh P.	684	43	300	341	
Sekaot, Purgunna Sekaot	4,877	3,385	72	1,420	
Khibranee	1,636	216	688	732	
Aoosree	430	..	170	260	
Hoosree	384	..	240	144	
Kathree, P. Kathree	737	..	309	428	
Khuthur, P. Khuthur	2,910	535	70	2,305	[in 1847.
Aghimanee, P. Aghimanee	1,433	248	1,185	..	Given up to Collector
Gullee, P. Katree	731	44	..	687	
Jakhree, P. Mutalevee	1,707	386	..	1,321	
Meannee, P. Doabh	3,453	488	1,453	1,512	
Gunj, P. Kheeral	1,885	1,564	..	321	
Junhar Belah, P. Laikpoor	1,946	100	..	1,846	
Bunah Belah, P. Bunah	1,107	257	283	567	
Aloolchund, P. Dadoo	1,535	517	445	573	
Aigoree near Khanoth, P. Khanoth ..	1,549	99	1,450	..	
Maree, P. Lokhgee	398	8	390	..	
Ketee Wunjeree, P. Ketee Khanoth ..	2,376	64	2,312	..	
Ketee, P. Mutalevee	4,610	4,520	..	90	
Mehrabpoor, P. Khitha	1,145	615	270	260	
Ranah	2,456	115	1,754	587	
Naseree, P. Lakhaot Dhinejah ..	1,177	52	..	1,125	
Athud, P. Lakhaot, near Bhawul Sha Munaijah	2,592	330	95	2,167	
Rhanoth, P. Rhanoth	6,768	701	..	6,067	
Maree	8,132	575	1,338	6,219	
Soossatee, (For band of Pinjaree, near Pullyah.)	499	124	..	375	
Hoodarany, P. Kantan Keeral ..	3,180	662	..	2,518	
Soorjanee, P. Kheeral	1,078	235	..	843	
Belah Laikpoor	7,467	1,315	..	6,152	
Belah Tikhoor	1,286	248	629	409	
Khokur, P. Dhundee	2,210	101	1,409	700	
Katiar, P. Kuskatiar, or Sungangyaree.	892	602	90	200	
Total Hyderabad Collectorate ..	82,986	22,419	16,035	44,532	
Belah Gharekha	3,540	1,579	..	1,961	
„ Sulling	3,795	400	840	2,555	
„ Hilaya	1,621	50	829	742	
„ Shah Lauka	1,440	480	240	720	
„ Sauda	1,575	170	400	1,005	
„ Jerruck	5,365	829	1,635	2,901	
Gug	2,451	583	1,118	750	
Karakha	2,000	..	..	2,000	
Meysah	5,773	104	323	5,346	
Majhendah	673	210	248	215	
Noorpoor or Bootiah	7,203	1,533	3,750	1,920	
Kurrunpoor	5,623	1,953	3,670	..	
Kyrah	63	18	..	45	
Total Kurrachee Collectorate ..	41,122	7,909	13,053	20,160	

Abstract of Forests, showing their Areas (continued).

Names of Forests.	Total Areas.	Areas in cultivation.	Waste Land.	Wood Areas.	Remarks.
Dahrasee, Sukkur	4,438	504	3,934	..	
Khuddapoor, „	1,382	..	1,382	..	
Turtee, „	2,436	198	..	2,238	
Dighat, „	2,003	410	..	1,593	
Undhull, „	5,335	205	5,130	..	
Baghasse, „	7,764	817	6,947	..	
Myee, Gatekee	619	48	571	..	
Charyheny, „	150	..	150	..	
Junah Dharee, „	391	45	346	..	
Soondrah, „	231½	1½	..	230	
Soondrah, „	146	146	..	..	
Afutpoor, „	324½	52½	272	..	
Bohee Kulhoree, Sha Mundah Kukhadah	755	..	755	..	
Sahangree, Underpoor, Puttic, Gahjah, Donah	1,387	..	1,387	..	
Kohurree, Galpoee	220	98	122	..	
Kokurree, Goondee, Roree	231	..	231	..	
Barah Puttaree, Roree	1,045	348	697	..	
Abdul Kerim, Sahpoor, Sadhee, Roree.	769	42	727	..	[by Collector.
Mungsee	5,953	1,307	3,646	1,000	Greater portion taken
Total Shikarpoor Collectorate..	35,580	4,222	26,297	5,061	
Grand Total..	1,59,688	34,550	55,385	69,753	

(Signed) WALTER SCOTT, Major,
Superintendent of Canals, &c. Scinde

(True copies)
(Signed) E. J. BROWN,
Secretary to the Government of Scinde.

Superintendent Canals' Office, Kurrachee, January 6th 1848.

Return of the Proceeds from Forests, and Establishment entertained exclusively on their account.

No.	Names of Forests.	June 1847. Grazing.	Firewood.	Building Wood.	Babool Seed.	July 1847. Grazing.	Firewood.	Building Wood.	Babool Seed.	August 1847. Grazing.	Firewood.	Building Wood.	Babool Seed.	September 1847. Grazing.	Firewood.	Building Wood.	Babool Seed.	Establishment. Carkoons, per month Rs. 30	Rs. 25	Rs. 20	Rs. 12	Rs. 10	Jemedar, per month Rs. 15	Peons, per month Rs. 8	Rs. 6	Rs. 5
1	Karokah	....	.....	....	....	5 5 9	49 9 2	....	0 1 4	11 8 6	61 7 3	....	..	7 12 3	....	....	..									
2	Gug	9 6 1	.....	....	21 12 0	20 2 6	0 5 0	....	0 12 0	20 1 7	.....	....	..	13 15 5	....	....	..									
3	Oonarpoor	165 11 7	0 1 6	....	5 0 0	42 4 6	.....	6 8 9	2 10 0	....	.....	....	..	78 10 0	10 5 6	....	..	..	1	..	1	..	..	1	12	..
4	Bootah	24 12 3	.....	....	2 0 0	1 5 6	.....	....	2 0 0	....	.....	....	..	3 3 5	....	....	..									
5	Majendah	24 2 11	.....	...	....	10 3 10	.....	3 8 0	....	0 4 0	.....	....	..	9 6 3	....	....	..									
6	Kutthur	....	.....	....	....	4 8 0	282 8 0	....	....	12 4 0	638 8 0	....	..	12 2 2	0 6 0	....	..									
7	Agamanee	....	.....	....	....	....	.....	....	....	....	.....	....	..	....	....	....	..									
8	Hoosree	....	.....	....	....	2 14 9	.....	....	....	5 10 0	0 10 0	....	..	2 4 0	....	....	..	..	..	1	..	..	..	..	5	..
9	Katro	14 6 6	.....	....	....	10 14 0	.....	....	....	6 6 0	.....	....	..	5 13 6	.....	....	..									
10	Meer Nusser Khan	278 0 4	1287 3 4	819 6 4	28 4 6	251 3 3	625 9 11	66 13 3	2 7 5	250 0 0	627 3 4	482 5 5	..	250 0 0	29 10 3	5 0 0	..									
11	Meer Mahomed	32 6 0	.....	....	....	2 14 0	7 0 0	....	....	3 7 11	81 15 1	5 9 6	..	6 15 2	11 9 0	18 12 0	..	..	..	..	1	1	1	10	..
12	Goondee	2 6 0	.....	....	....	11 5 0	0 4 0	....	....	1 11 6	.....	....	..	2 11 7	47 12 3	....	..									
13	Katree	40 7 6	7 8 0	....	45 4 6	6 0 0	.....	....	....	0 14 2	3 11 9	2 8 5	..	4 7 11	17 11 0	2 5 6	..									
14	Ghullee	36 4 6	26 0 6	....	....	7 0 3	77 10 0	....	....	7 10 9	28 13 0	....	..	11 8 2	21 0 9	....	..	1	..	..	..	..	..	..	2	..
15	Katee	29 4 9	31 13 6	....	1 1 5	23 15 0	.....	234 10 3	0 15 6	19 14 2	.....	141 5 5	0 3 0	38 1 10	78 3 1	....	0 2 3									
16	Jakree	10 13 0	0 5 0	....	....	5 9 0	13 7 10	....	....	6 15 0	.....	13 10 0	..	6 10 8	14 11 6	....	0 6 9									
17	Sikaot	66 9 5	12 11 4	....	26 0 5	30 11 3	1 0 9	....	....	8 14 2	.....	....	..	29 3 4	5 3 8	....	0 8 0	..	1	..	..	..	..	..	8	..
18	Kabranee	11 8 9	0 6 0	....	....	14 0 3	.....	....	....	10 13 7	.....	....	..	14 12 0	....	1 8 0	..									
19	Khanote	46 8 1	.....	....	....	8 6 9	.....	....	....	17 15 0	.....	....	..	23 5 2	....	....	..									
20	Bbanate	4 6 6	.....	....	....	2 3 9	.....	....	....	....	.....	....	..	2 12 0	....	....	..									
21	Katee of Meer Mahomed	14 6 6	.....	....	....	15 14 9	.....	....	....	0 15 0	.....	....	..	11 8 0	....	....	..	..	..	1	..	..	..	..	8	..
22	Rhanah	9 1 9	.....	....	....	12 0 5	.....	....	....	7 4 3	.....	....	..	7 0 6	....	....	..									
23	Maree	10 11 6	.....	....	....	....	.....	....	....	5 10 0	.....	....	..	9 12 10	....	....	..									
24	Merapore	2 10 3	.....	....	....	0 12 4	.....	....	....	0 14 3	1 8 0	....	..	5 7 7	....	....	..	..	1	..	..	..	..	1	5	..
25	Mhud	11 11 6	.....	....	....	3 0 0	.....	....	....	....	.....	....	..	6 1 7	....	....	..									
26	Nasree	0 5 4	.....	....	....	0 6 3	.....	....	....	0 9 0	.....	....	..	1 3 5	....	....	..									
27	Veran	....	.....	....	....	....	.....	....	....	19 4 0	.....	....	1 0 0	16 8 8	....	....	..									
28	Soonda	....	.....	....	....	....	.....	....	....	2 15 4	.....	9 0 3	..	6 0 7	....	....	..	..	1	..	..	..	..	2	8	..
29	Hilyah	....	.....	....	....	....	.....	....	....	1 12 4	.....	....	..	7 6 9	....	....	..									
30	Lulling	....	.....	....	....	....	.....	....	....	4 9 0	.....	....	..	1 13 0	....	....	..									
31	Garkha	....	.....	....	....	....	.....	....	....	22 2 8	.....	....	..	31 4 1	....	....	..									
32	Mooradpoor	....	.....	....	....	....	.....	....	....	4 3 6	.....	....	..	18 1 3	....	....	..									
33	Huzaree	....	.....	....	....	....	.....	....	....	....	.....	....	..	8 2 0	....	....	..									
34	Gunge	....	.....	....	....	....	.....	....	....	....	.....	....	..	5 6 3	....	....	..	..	1	..	..	..	..	1	2	7
35	Soorj	....	.....	....	....	....	.....	....	....	....	.....	....	..	3 13 7	....	....	..									
36	Hooderanee	....	.....	....	....	....	.....	....	....	11 6 6	.....	....	..	21 11 5	....	....	..									
37	Pinnah	....	.....	....	....	....	.....	....	....	11 3 4	.....	....	1 0 0	12 1 0	....	....	..									
38	Laikpoor	....	.....	....	....	....	.....	....	....	34 2 4	.....	....	..	12 6 5	....	....	..									
39	Keersur	....	.....	....	....	....	.....	....	....	20 3 6	.....	....	..	23 11 2	....	....	..									
40	Kuddee	....	.....	....	....	....	.....	....	....	15 12 0	.....	....	..	14 5 6	....	....	..	..	1	..	..	..	..	..	..	10
41	Soosatee	....	.....	....	....	....	.....	....	....	5 0 6	.....	....	..	1 1 6	....	....	..									
42	Phuttah	....	.....	....	....	....	.....	....	....	0 2 2	.....	....	..	....	....	....	..									
43	Moolchund	45 4 6	.....	....	....	1 9 6	.....	....	....	4 8 6	.....	....	..	1 15 6	....	....	..									
44	Bunah	15 5 9	.....	....	....	15 5 5	.....	....	....	....	.....	....	..	....	....	....	..									
45	Kattihar	....	.....	....	....	8 6 10	.....	....	....	8 1 2	.....	....	..	....	....	....	..	..	1	..	..	..	..	1	..	9
46	Khokur	0 1 0	.....	....	....	8 7 0	0 0 6	0 1 3	....	6 15 8	0 3 0	3 15 6	0 11 0	3 15 0	....	....	..									
47	Tikkhore	17 14 0	.....	....	....	9 3 8	.....	1 12 6	....	5 13 1	.....	....	0 1 6	4 8 9	....	....	..									
48	Rambhoree	1 11 0	.....	....	....	....	.....	....	....	4 5 0	.....	....	..	....	....	....	..									
49	Kurrumpoor																									
50	Chunah																									
51	Tultee	....	.....	121 15 0	....	....	.....	....	....	....	.....	13 8 0	..	....	....	....	..	..	..	1	..	..	2	7	..	
52	Mugsee																									
53	Leesharee																									
54	Khyroderah																									
	Total	926 7 3	1366 1 2	941 5 4	129 6 10	536 1 7	1057 6 2	313 5 6	10 0 11	582 3 5	1443 15 5	671 14 6	2 15 0	759 1 2	236 9 0	27 9 6	1 1 0	2	7	3	1	1	1	9	67	26
	Forests in Upper Scinde	....	.....	244 12 8	....	....	.....	....	....	....	.....	10 0 0	..	....	....	870 6 4	..	..	..	1	..	..	2	..	..	16

Superintendent Canals' Office, Kurrachee, 6th January 1848.

(Signed) WALTER SCOTT, Major,
Superintendent of Canals, Survey and Forests, Scinde.

(True copy)

E. J. BROWN,
Secretary to the Government of Scinde.

Statement of the Strength of Scinde Survey, Canal and Forest Department, showing the Charges from August 1843.

No.	Rank.	Names.	1843.				1844.												1845.												1846.												1847.												Amount of Salary.	Remarks.
			August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.		
1	Supt. and Captain.	W. E. Baker, from 15th Sept. 1843		1	1	1	1	1	1	1	1	1	1	1	1	1																																						Rs. 1000	
2	Do.	W. Scott, from 15th Oct. 1844															1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1000	
1	Assist. do. and Lieut.	R. Maclagan, 2nd Class, 20th Sept.		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																								300	
2	Do.	F. Whiting, " 1st "		1	1	1	1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	1	1	1	1	1	1	1	1	1	1	1																								300	Absent on leave from 12th January 1844.
3	Do.	J. C. Blagrave, " 9th "		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																								300	
4	Do.	D. C. Vanrennan, 1st Nov. 1843			1	1	1	1	1	1	1	1	1	1	1	*1	*1	*1	*1	*1	*1	*1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	300	Promoted 12th Nov. 1845 to Rs. 400; absent on sick leave from Oct. 1844 to April 1845.
5	Do.	T. R. Burton, from 15th Nov. 1844															1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	300	
6	Do.	Mildmay, from 14th April 1845																		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	300	
7	Do.	Edwards, from 27th Aug. "																								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	300	
8	Do.	Creagh, from 5th " "																								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	300	
9	Do.	Campbell, from 27th Oct. "																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	300	Promoted 12th Nov. 1845, at Rs. 400.
10	Do.	W. Pirie, from 5th Jan. 1846																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	300	Promoted from July 1847, at Rs. 400.
11	Do.	D. R. Lambert, " " "																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	300	
12	Do.	A. D. Campbell, 23rd Feb. "																													1	1	1	1	1																		400	
13	Do.	A. G. Vanrennan, 8th April "																																1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	300	
14	Ditto and Captain.	F. A. Wetheral, from 6th Aug. 1846																																									1	1	1										300	
15	Ditto and Lieutenant	C. F. Dansey, from 23rd Oct. "																																											1	1	1	1	1	1	1	1	1	1	300	Promoted from July 1847, at Rs. 400.
16	Do.	F. Dawson, from 2nd Nov. "																																											1	1	1	1	1	1	1	1	1	1	300	
17	Do.	W. D. Dickson, from 16th Nov. "																																											1	1	1	1	1	1	1	1	1	1	300	
18	Do.	T. R. Teschmaker, 15th Apr. 1847																																																			300	
19	Do.	A. DeLisle, from 21st Aug. "																																																1	1	1	1	300	
20	Do.	B. Burton, from 3rd Nov. "																																																		1	1	300	
21	Do.	W. Creagh, from " "																																																		1	1	300	
1	Assistant Surveyor.	E. W. Hoppner, 10th Aug. 1843; Rs. 300	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	*1	*1		300	[in Nov. 1847.
2	Do.	N. Hodges, from 1st Feb. 1844; " 250						*1	*1	*1	*1	*1	*1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	250	Joined in July 1845, and promoted to Rs. 300
3	Do.	R. Chill, from 30th Sept. " " 250														*1	*1	*1	*1	*1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	250	Joined in February 1845.
4	Do.	G. Elander, from 12th Dec. 1846																																																				250	Employed in Quarter Master General's Office till 15th December 1847.
1	Sub-Assist. Surveyor.	F. R. Sullivan, 29th Aug. 1843	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	
2	Do.	J. Thompson, from " "		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	
3	Do.	J. Martin, from 13th Sept. 1843		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	
4	Do.	Craig, from 16th " "		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	
5	Do.	A. Bremaer, 15th Aug. "		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	
6	Do.	Millard, from 1st Jan. 1846																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	
7	Do.	W. Jones, from 4th Dec. 1845																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	Promoted from Nov. 1847, at Rs. 200.
8	Do.	Pegler, " " "																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	
9	Do.	Brabazone, " " "																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	Promoted from Nov. 1847, at Rs. 150.
10	Do.	Crawford, " " "																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	
11	Do.	Gardener, " " "																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	
12	Do.	Brice, " 8th " "																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	
13	Do.	G. Briggs, from 12th Nov. 1846																																																			100	
14	Do.	C. R. Critchell, from 3rd Apr. 1847																																																			100	
15	Do.	W. Abraham, from 12th July "																																																		100	Employed in making botanical drawings for Dr. Stocks.
1	Native Surveyor.	Alladad Khan, 1st March 1844; Rs. 70								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	70	
2	Do.	Mahomed Humid, 1st Feb. " " 40						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	40	Promoted to Rs. 70 from Dec. 1846; sick
3	Do.	Bhugwandass, 1st June " " 35										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	35	Promoted to Rs. 40 from Dec. 1847.
4	Do.	Jeewajee Babjee																																																			30	Promoted to Rs. 35 from Dec. 1846.
1	Wood Ranger.	J. H. Roberts, 1st May 1844															1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	300	
2	Deputy do.	J. Farrel, from 3rd April 1847																																																			200	
3	Do.	W. Williams, 22nd Oct. 1845																																																			200	
4	Do.	Barritt, from 17th Nov. "																																																			200	

Those marked thus * were non-effective.

(Signed) WALTER SCOTT, Major,
Superintendent of Canals, Survey and Forests, Scinde.

Superintendent Canals' Office, Kurrachee, 6th January 1848.

(True copy)
E. J. BROWN,
Secretary to the Government of Scinde.

[*Abstract*

Abstract of the foregoing Statement.

Designation.	Number of Officers employed during the years					Total Monthly Amount of Salary of each Officer.	Remarks.
	1843.	1844.	1845.	1846.	1847.		
						Rupees.	
Superintendent	1	1	1	1	1	1,000	
Executive Canal Officers ..	4	4	7	9	9	300	1 promoted to Rs. 400 from November 1845, and 2 from July 1847.
Assistant Surveyors	1	3	3	3	2	300 & 250	1 resigned, and 1 promoted from Rs. 250 to 300.
Sub-Assistant Surveyors....	4	2	8	9	7	100	6 entertained in November 1845; 1 promoted in November 1847 to Rs. 200; and 1 in the same month to Rs. 150.
Native Surveyors	..	3	3	3	3	70, 40, & 35	
Wood Ranger	..	1	1	1	1	300	
Deputy Rangers.....	..	..	2	2	2	200	

(Signed) E. J. BROWN,
Secretary to the Government of Scinde.

(True copies)
A. MALET,
Chief Secretary.

LETTER FROM MAJOR W. SCOTT, SUPERINTENDENT OF CANALS, WITH EXTRACT EXEMPLIFYING HIS TABULAR STATISTICAL STATEMENTS.

GENERAL No. 572.

No. 77 OF 1847-48.

From

The SUPERINTENDENT OF CANALS, Scinde,

To

The SECRETARY TO THE SCINDE GOVERNMENT.

Dated 22nd November 1847.

SIR,

I have the honor to transmit accounts of the districts of Hyderabad, arranged as nearly as possible in consecutive order from north to south, and west to east.

2. Each purgunna occupies 4 pages of paper. The 1st shows—

The amount of wheel and sailabee cultivation, the quantity of land cultivated in jagheer.

The revenue returns of khurreef and rubbee for three years. These two returns, in fact, show the value of the purgunna to Government, and form a sort of index to those to be first improved: for example, it would be injudicious to carry out large improvements where the greatest portion of cultivation was in jagheer.

The length of the local canal guz in English feet.

The equivalent of 10,000 guz in cubic yards.

The cost of 1,000 cubic yards in Co.'s Rupees, after all deductions, together with the equivalent number of cubic guz, and the average price in the purgunna. I intended to show the cost in local rupees, but it would have caused some further delay, and seems not of much importance.

The names of the most important canals.

The quantity of canal clearance, in all cases for 4 years, and in many for several years under the late Government—the latter returns are incomplete.

The amount estimated last year by the Kardars as the probable sum required in each district. This is entered in red ink [printed in bold type].

3. The 2nd and 3rd pages relate to the amount of taxation under the Ameers.

4. The 4th page shows the local custom of deductions on the canal payments, and general remarks on the state of the district. I regret to say that these are very incomplete.

5. Some difficulty has been found in ascertaining the precise system of canal clearance under the Ameers, owing to the want of returns, but it appears that in Nusseer

Khan's districts an allowance of 3 kasa per khurwar, or 5 per cent., was made to Mokhadims, who then cleared their own canals. This system was called Mokhadinnee.

6. The forests are entered at the foot of the 1st page of their respective districts, with an abstract of their extent, the quantity of cultivation, waste land, and actual forest.

7. In the first page, the amount entered in the column " Cost in Rupees," shows the total value of excavation in 1258, 1256, 1255—the cost in 1257 is unknown. The numbers in the same column below 1255 show the sums paid for unmeasured or job-work (Bib Mookhtee), and is in addition to the cost of the number of cubic guz. It would take several months to reduce the whole of the items in the column of " Local Cubic Guz" to the cost in rupees—it could, however, be framed in the old revenue accounts.

Similar accounts of the purgunna in the Kurrachee Collectorate will be forwarded as soon as ready. Some delay has been caused by the sickness of several of the subordinates of the department.

I have the honor to be, &c.

(Signed) WALTER SCOTT, Major,

Superintendent of Canals, Survey and Forests, Scinde.

Kurrachee, 22nd November 1847.

(True copy)

(Signed) E. J. BROWN,

Secretary to the Government of Scinde.

(Extract.)

HYDERABAD COLLECTORATE.

Purgunnas in Charge of Lieutenant Lambert.

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Gucheroo Cheneja 1
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Mutaulwee 18

All the Kurrahs appear to have been done at Government expense.

MAHOMUD,

GUCHEROO CHENEJA.

Land cultivated in 1257.	Churkha.	Hoorla.	Flooded Land. B.	Flooded Land. W.
Government Land	1154	269		
Jagheer Land	549	142		

		Khurreef. Khr.	Khurreef. Kasa.	Khurreef. Rupees.	Rubbee. Khr.	Rubbee. Kasa.	Rubbee. Rupees.
Amount of Revenue in ..	1253	1448	56				
	1254	410	56	1016	225	3	
	1255	1035	21	1971	374		
	1256				498	49	186

Length of Local Canal Guz — Cub. 1-10-6 Guz

10,000 Local Guz equal to Cubic Yards — Kharee Embankment paid per Beega dug 1 Guz. 2-1⅔ deep. — 2282.

Nominal Value of 10,000 Guz, in Local Rupees	
Actual value, after deductions, in ditto	
Value of 1,000 cubic yards, in Co.'s Rupees	32 1 0

4381 @ 120, 36-8-0

Names of principal Canals, and their width in Local Guz at bottom.

Amount of Kardar's Estimate .. ..

EXTENT OF CANAL CLEARANCE.

Season.	No. of Canals cleared.	Cubic Local Guz.	Cost in Rupees.	Embank. B	Embank. W
1258	3	51300	397		
57	5	6112			
56	30	95254	707		
55	55	312967	2631		
54					
1253	47	30469		2	16
1252	38	28761		13	12
1258	....	....	**784 0 0**		

Names of Canals.	Width.	Remarks.
Kadhoro	9	
Nangun-Putteen	2	
Moong Kay	2	

Total.	Cultivated.	Waste.	Baubul.

Statement showing the Share of the Crops taken by Government, and its equivalent Per-centage on the whole Produce.

Name of Purgunna or District.	Nature of Cultivation.	Description of Tax.	Amount of Tax.	Per	On	Per-centage		Remarks.
						Of each Item.	Total.	

Cheneja Gucheroo.—This is the most northerly district of the Hyderabad Collectorate, and the general remarks applicable to this are also applicable to all those districts as far south as Mutteabree. The country is low, easily watered, and highly productive. Most of the canals which run down to the eastern districts—Moorporo, Khat, Meerwa, Roopa, &c.—take their rise in these districts, and it would be very desirable to prevent the water of the large canals being very extensively used in the upper part of their course. As the case stands at present, their cultivation is now very dependent on these canals. In some instances, when the line of the canals as respects the eastern districts is defective, as in the Sangroo, it will probably be the best plan to form a new head to the canal, leaving the present canal for the use of the upper purgunnas.

CUSTOM.

Deduct $\frac{1}{20}$ 5 per cent. at Rs. 3-8-1 per cent.

[*Details of other Purgunnas follow in similar forms.*]

(True extract)

(Signed) E. J. BROWN,

Secretary to the Government of Scinde.

(True copy)

A. MALET, Chief Secretary.

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on 01 February, 2020